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NIGHT LETTERS BY WIRE.

The public naturally is skeptical of the benefits promised it by monopolies and consolidations. Yet it is safe to predict that the new alliance of the Bell telephone interests of the country with the Western Union Telegraph Company will bring most desirable results both as to efficiency and economy. It is announced that a "night letter" of fifty words may be filed before midnight for transmission, and this letter will be telegraphed to the objective point and promptly mailed so the receiver will get it with his early mail the next morning. The charge is to be the same as for the usual ten-word telegram. This message can be filed by any telephone subscriber over his telephone with the nearest telegraph office.

This is a practical and most useful advance in the work of transmitting intelligence. A greater part of the vast telegraph system, crowded to capacity during the day, lies idle at night. At small additional expense these idle wires can be made to earn something, and also accommodate the public. The new telephone-telegraph organization regards these night messages as "by-products," capable of being handled at very low rates so long as no noticeable increase in fixed charges is incurred. Telephone offices everywhere are ever open for business, and any one wishing to send a telegram after the Western Union office is closed can dictate it to the telephone company, which will transmit it to the nearest all-night telegraph office for transmission to the point of destination.

These plans, which are in process of development, will be watched with unusual interest by the public, and, we believe, will prove of great advantage and convenience to our commercial and social life.

STEAM TURBINES.

The steam turbine has two enormous advantages over the reciprocating steam engine, viz., its capability of utilizing the expansion of steam in the lowest obtainable absolute pressures, and its practicability of being made in extremely large single units.

As is well known by all engineers, there is about as much available energy remaining in steam when exhausted at atmospheric pressure as there is in the steam between a pressure of 150 pounds per square inch and atmospheric pressure. With the reciprocating engine a large part of

this energy has to be thrown away owing to the impracticability of making low-pressure cylinders of sufficient size to utilize the large volume of the exhaust, without losing more in frictional and other losses than would be gained by the increased expansion. The amount of possible expansion in the steam turbine, however, is limited only by the degree of vacuum obtainable, and with the recent great improvements in condenser practice, the efficiency of steam consumption per indicated horsepower has been improved to a remarkable degree. It may be mentioned in this connection that between twenty-five and twenty-six inches, or twenty-six and twenty-seven inches, of vacuum, there is a gain in efficiency with the steam turbine of about four per cent; from twenty-seven to twenty-eight inches, the gain is a further five per cent, and from twenty-eight to twenty-nine inches, of beween six and seven per cent.

With regard to the advantages of increasing the size of the generating units, Mr. Dugald C. Jackson in a paper entitled "The Applicability of Electrical Power to Industrial Establishments," presented at Boston, Mass., on February 16 last and reported in these columns last week, pointed out that the centering of power generation into a single generating plant for any large establishment is accompanied by economies in power generation that are of themselves appreciable, besides contributing to reliability. Mr. Jackson maintained that by the use of large steam turbines, installed in association with boilers provided with adequate labor-saving appliances, the labor cost may be reduced to a figure that vies with the labor cost pertaining to the operation of hydraulic generating plants equipped with machines of equal size. He further mentioned that the steam economies derived from the newer steam turbines are remarkably satisfactory, and that for the larger steam-turbine plants, the first cost per kilowatt of capacity of plant, including land, buildings, and machinery, falls off to such a degree that a steam-turbine plant may nearly rival a hydroelectric plant in the gross cost per kilowatt-hour of energy delivered at the switchboard. This is occasioned by the fact that the fuel cost pertaining to the steam-turbine plant has an offset in the charges caused by larger first cost per kilowatt of capacity of hydraulic plant. Mr. Jackson asserts that concentration of steam-electric generating plants will afford considerable economies when the concentration is carried out much further than heretofore, and that this has now been made possible by the advantages attendant on the utilization of large steam turbines as prime movers.

An important point to be noted in regard to the electrical application of the steam turbine is its unique adaptability for direct driving of alternating-current generators. In October of last year, during the course of a series of three Cantor lectures delivered by Mr. Gerald Stoney before the Royal Society of Arts in London, the lecturer showed that turbines can be constructed with similar stresses and dimensions to give outputs varying as the square of the dimensions of the machine and varying inversely as the square of the speed of revolution. Alternators also obey the same law of varying inversely as the square of the speed, and so it follows that direct-connected alternators and turbines go up in size together, thus causing the size of the turbo-alternator to be limited only by practical requirements. Direct-current machines, on the other hand, have an output about proportional to the speed, but even in this case, by using dynamos in tandem for the larger sizes, the difficulty of correctly designing large direct-current units is largely minimized.

The advantages and properties of the various designs of turbines are so well known that it will not be necessary here to go into these details. For a new installation the merits of the complete turbine taking steam at high pressure and exhausting to a low vacuum, have been well demonstrated. When it is necessary to increase the output of an existing reciprocating-engine plant, especially when this is noncondensing or otherwise inefficient, the installation of a low-pressure turbine has marked advantages. At a recent meeting of the American Society of Mechanical Engineers at Boston (November 17, 1909), Mr. Henry G. Stott, chief engineer of the Interborough Rapid Transit Company, of New York, stated that the addition of a low-pressure turbine to one of the 5,000-kilowatt units in the Fifty-ninth Street station showed an improvement in steam economy of about twenty-three per cent, and a total improvement, including operating expenses, of some thirty per cent.

The mixed-pressure turbine, although exceeding in first cost the exhaust turbine, is undoubtedly more efficient in such cases where full use can be made of its peculiar advantages. These latter were summarized by Mr. J. N. Bailey, in a paper read on November 13, 1909, before the Manchester (England) Association of Engineers, as follows: "The mixed-pressure turbine makes for a particularly flexible unit, as generally it is capable of doing: (1) any load up to heavy overloads on high-pressure steam; (2) full load on low-pressure steam; (3) any load up to heavy overloads on mixed high-pressure and low-pressure steam. With the exception that this is a slightly more complicated turbine both as regards blading and valve gear, and the steam consumption is slightly worse than a pure exhaust turbine, there is little doubt but that it approaches very nearly the ideal design for industrial works." In the mixed-pressure turbine, it may be explained, there is a high-pressure part revolving idly when exhaust steam is used, and when the supply of exhaust steam is not available, this high-pressure part is automatically supplied with live boiler steam so that the turbine continues to be driven as before.

The possibilities of the steam turbine are as yet by no means exhausted, and it is confidently predicted by many engineers that by the use of composite designs many additional special and economical uses will be found for it in the near future.

ELECTRIFICATION PROSPECTS FOR BOSTON.

A noteworthy feature of the present session of the Massachusetts Legislature is the growing public demand for the electrification of the steam railroads serving the Boston metropolitan district. A number of bills with this object have been introduced, and a large and increasing movement against the steam locomotive is manifested. Consequently the recent remarks of President Charles S. Mellen of the New York, New Haven & Hartford Railroad before the New England Boot and Shoe Club upon the specific problem of electrification at Boston present particular interest.

In brief, Mr. Mellen declares that electrification is certainly coming for all the standard trunk lines, especially those with congested traffic. He recommends that no legislative action be taken to force the development at Boston, however, on the ground that his company is proceeding as rapidly as possible to determine the best methods and equipment for the service, leading toward a decreased cost for a given section of line, compared with the cost of the initial and epoch-making installation outside New York. Mr. Mellen points out that the cost of electrification at Boston for a given area is likely to be from four to eight times what it was in New York, on account of the fan-shaped character of the suburban lines, which branch to many diverse points immediately without the terminal yard limits on both the north and the south sides of the city. Nevertheless the New Haven is planning to banish the steam locomotive from its Boston lines, but the company feels that haste in this matter would only lead to excessive investment cost and desires a little more time in which to determine the best engineering details for both passenger and freight service. Closely related to the problem is the construction of a tunnel for heavy train service between the North and South stations.

Mr. Mellen's announcement that the New Haven proposes to continue a pioneer in the work of electrification postulates the ultimate equipment of the entire New York-Boston service, a consummation initiated by the installation of electric motive power on a small section of the New York division of the system. It is well for the public to appreciate in some degree the magnitude of such a problem, and frank discussions like that quoted above should do much to restrain the enactment of ill-considered measures, whose cost must inevitably be borne by the communities served, in the long run. It is too much to expect that the layman can realize all at once the enormous intricacy of the problem of electrifying a trunk line and terminal system, and a reasonable time for the planning and execution of such work may well be demanded. Admirable as have been the results on many electrified railway lines in different parts of the world, it is well to remember that there is no such thing as finality in the equipment available for this purpose, and that thorough standardization must be long postponed. Witness the improvements already made in both the New York Central and the New Haven locomotives, and the novel designs adopted by the Pennsylvania Railroad Company for the tunnel and suburban service at New York. The cost of replacing recent electrical equipment with more modern apparatus is bound to be very large, even upon a system of moderate mileage.

The problem of electrification is now mainly one of engineering, and its solution should be simply a question of reasonable time for the conditions evidenced in New England. It is safe to say that if the public can see the companies making definite studies of the situation radical action by legislative bodies may be forestalled, but if the policy exhibited in the past in some instances continues to be followed, with little or no sign of action by the railroads, some pretty drastic legislation is likely to be enacted at the present sessions. The situation is becoming decidedly interesting in legislative circles, and unless all signs fail, some very definite steps toward the substitution of electricity will be taken in Massachusetts within the next two years.

DISCRIMINATION IN RATES.

The American public is very quick to resent any unjust discrimination against it. In all lines of business it demands fair play but especially from public utility or quasi-public corporations. This feeling has expressed itself in the formation of the Interstate Commerce Commission and of numerous state railroad and public service commissions. One of the greatest problems presented to these bodies is the question whether certain schedules of rates are equitable to all concerned and it is fortunate that in the great majority of instances the decisions relative thereto have been fair to both the public and the private interests involved.

In the business of electrical supply from central stations it is becoming very generally regarded as a foolhardy policy to adopt a system of universal rates, unlimited as to the time, amount or character of the service rendered. By increasing the load factor of the station the production costs per unit of energy generated are diminished and a general reduction of rates made possible. This means the building up of long-hour and off-peak business, to cultivate which a carefully planned system of discriminatory rates is necessary. Inasmuch as things that are legitimate are not necessarily always legal, it is interesting to know the position of the law and of the courts on the question of reasonable discrimination. On other pages of this issue will be found an excellent article on this subject by Mr. Alton D. Adams, who has devoted years of study and practice to the legal as well as physical aspects of the question of public utility rates. Mr. Adams points out that the courts in the main have been as fair-minded as the public service commissions in sanctioning discrimination in rates, where it has been shown that the service rendered warranted it or the upbuilding of the public utility industry demanded it. But in all cases where discrimination is approved, it is approved only to a reasonable extent.

Commission News from New York.

The New York State Public Service Commission, Second District, has authorized the Niagara Falls Power Company to execute and deliver its refunding general mortgage to secure coupon and registered gold bonds of this company maturing January 1, 1932, and bearing interest at the rate of six per cent to the aggregate amount of $20,000,000; to issue presently refunding bonds to the amount of $9,074,000. The proceeds of the gold bonds sold at this time are to be used $2,998,000 to refund ten-year six per cent debentures due April 1, 1910; $3,000,000 series A to refund ten-year debentures due October 1, 1911; $1,980,000 series B to refund ten-year six per cent debentures due November 1, 1914; $1,096,000 series C ten-year six per cent debentures due November 1, 1914; also refunding bonds to the amount of $1,021,000 to be used for the acquisition of property and extension and improvement of its plant and system.

The Syracuse Lighting Company has been authorized by the commission to issue its extension and improvement mortgage six per cent, ten-year gold bonds to the amount of $354,000, the bonds in question to be sold at not less than ninety-five and the proceeds to be used for construction, extensions, improvements and betterments to the plant. The commission cuts out $1,675 for an electric runabout and motor cycles from the amount asked for by the company. The company is also authorized to use the balance of the proceeds of $143,000 of extension and improvement bonds authorized by the commission on July 12, 1909, and of the sum remaining in the applicant's debenture fund July 1, 1909, which balance amounts to $8,689.51, is also authorized to be used for extensions and improvements.

Several hearings have been given upon the application of Urban O. Webb, who desires to operate an electric light plant in the village of Edwards, St. Lawrence County. As there is no system of lighting in the village at the present time and no one appeared in opposition the application was granted.

The applications of Charles P. Dickinson for consent to transfer to Charles H. Stokes a franchise for electric light, heat and power in the town of Wawarsing, Ulster County, and of Charles P. and Arnold G. Dickinson for consent to transfer to Charles H. Stokes franchises for electric light, heat and power in the towns of Wawarsing, Hurley, Marbletown, Rosendale and Rochester, Ulster County, were also heard and granted.

Report of the Commissioner of Patents.

The following abstract is taken from Commissioner of Patents Edward B. Moore's report for 1909, which was recently submitted to Congress.

In 1909 there were received 64,408 applications for mechanical patents, 1,234 applications for design patents, 197 applications for reissues of patents, 7,247 applications for registration of trade-marks, 554 applications for registration of labels, and 190 applications for registration of prints. There were 37,261 patents issued, including designs, 160 patents reissued, and 4,184 trade-marks, 492 labels, and 148 prints registered. The number of patents that expired was 22,661. The number of allowed applications awaiting the payment of final fees was 12,748, and the number forfeited for non-payment of the final fees, 7,699. The total receipts were $2,042,828.14, the expenditures $1,955,151.14, and the surplus of receipts over expenditures $87,677.00. The total balance to the credit of the Patent Office in the Treasury of the United States on January 1, 1910, was $6,978,402.89.

Committee on Electric Vehicles.

President Murray of the Association of Edison Illuminating Companies has appointed J. T. Hutchings chairman of a committee, to be known as the Committee on Electric Vehicles.

This committee will study the electric vehicle situation in order to emphasize the advantages of this form of conveyance over the horse-drawn for the purpose of introducing the former in cities where the Edison companies operate.

Mackay Companies Sell American Telephone and Telegraph Stock.

According to a statement made by Clarence H. Mackay, president of the Mackay Companies, the 82,000 shares of American Telephone and Telegraph stock held by them have been sold. This action was recommended in the annual report of the companies.

While the buyer has not been disclosed it is known that a Boston syndicate of bankers made arrangements some time ago to take over the shares.

Pennsylvania Tunnel Opening Delayed.

The Pennsylvania Railroad tunnels under the East River will not be opened to the public until May 30, and through trains under both the North and East Rivers will not be run until September 1. This means that the Pennsylvania station at Seventh Avenue and Thirty-third Street, Manhattan borough, New York city, will not be opened until Decoration day. Cold weather is given as the cause for the delay. It is said that it has been difficult to get materials and that the many snowstorms this winter hindered the work on the station.

According to the schedule which it is now hoped can be carried out, the station and East River tunnels will be in condition to receive trains on Decoration day, and they will be run between the station and the mouth of the tunnels in the Long Island Railroad yard at Sunnyside. The tunnel trains will not be run through to Jamaica. Instead, connection with the regular trains running in and out of the present Long Island depot will be made at Sunnyside.

New York Section of the Illuminating Society to Meet.

The New York section of the Illuminating Engineering Society will hold its March meeting in the United Engineering Society's Building on the evening of March 10.

The papers to be read at this meeting will be "The Relationship of Decoration to the Illumination Engineer Practice," by C. R. Clifford; "Color Measurements of Illuminants, a Resumé," by Dr. H. E. Ives and "A Standard for Color Values of Artificial Lights —The Moore Wlütelight," by Dr. McFarlan Moore. These subjects will be illustrated by stereopticon views and demonstrations will be given where this is possible.

Dr. E. P. Hyde, president of the Illuminating Engineering Society will preside.

Wireless for All Vessels.

A bill, ordering the Government to equip all its vessels with wireless apparatus, has been introduced into Congress. In explanation of the bill Representative O'Connell, who introduced it, stated that such a law would have undoubtedly prevented the loss of the tug Nina.

Edward J. Hall.

Edward Julius Hall was recently chosen Chairman of the Executive Committee of the Western Union Telegraph Company. Mr. Hall is also first vice-president of the American Telephone and Telegraph Company, and in working out the efficiency of the combined service of these two great intelligence-transmission companies, he very properly becomes the active executive.

Mr. Hall was one of the real pioneers of the telephone business of the United States, having become interested in 1878. He left the Buffalo Telephone Company, of which he was general manager, to accept the general managership of the American Telephone and Telegraph Company, and has been a very active participant in this company's remarkable development. Mr. Hall is very widely known in the telephone field; of modest and quiet method, yet one of the busiest and most effective executives in all New York.

A recent interview with Mr. Hall that appeared in the New York *Daily Globe* is quite characteristic of the man, and from it we publish the following interesting information respecting the "Night Letter" plans of the combined telephone and telegraph service:

Then it took eight or nine more questions for me to find out that he was one of the oldest members of the telephone companies—that he had become a general manager for a company in Buffalo in 1878 when the industry was a mere infant, and that he had grown and prospered with it.

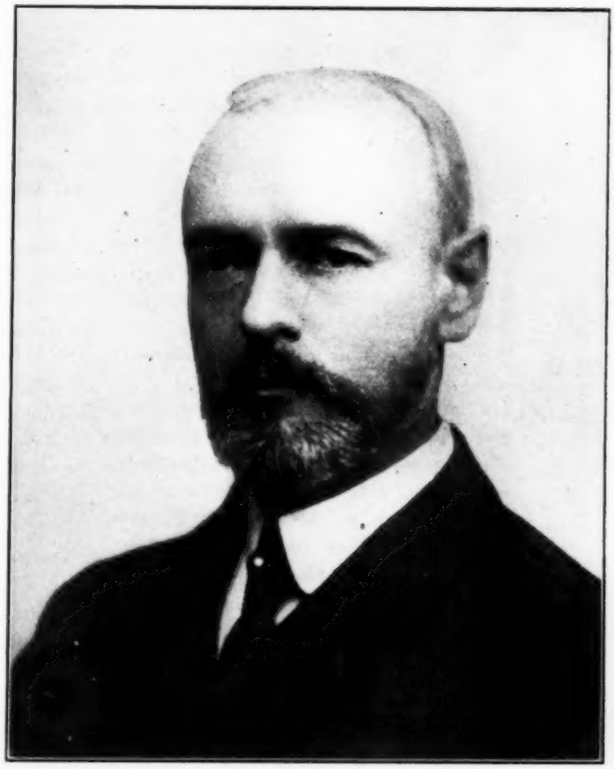
"Did you think the telephone or the telegraph would get to be the enormous business it is when you first started with them?" was the next question. Surely, I thought, here is a chance for a little reminiscence. People I've talked to before about the beginning of telephones have been glad to. But Mr. Hall simply answered my question as courteously as he had the others.

"I don't think any one thought it would ever grow to the proportions it has," was his reply.

Then I asked about ten more questions and found that Mr. Hall comes from Perth Amboy, N. J., and that he don't think the public is much interested in him personally (and all the time I knew they were), and then I started to go.

That's where I got my only surprise. As he held open the door for me Mr. Hall spoke of his own accord! He may think the public is not interested in him personally, but he also thinks they are interested in the telephone and telegraph, or anything that will conduce to their further comfort, so he suddenly spoke about them.

"You can say," he said, "that it will only be a short time until everybody can use the telephone and telegraph as



EDWARD J. HALL.
Newly-elected Chairman of the Executive Committee of the Western Union Telegraph Company—Vice-President American Telephone and Telegraph Company.

we do here. I think they will be especially interested in our newly inaugurated 'night letter,' for when we have all our plans made and put into effect, that one makes it possible for a person to send fifty words at night for the price of a ten word telegram, and the person to whom it is addressed will receive it the first mail the next morning, for it will be mailed immediately it is received. Then I think nearly every one will be glad to know that they can soon call up a telegraph office and give their message, having the bill for it sent with the regular monthly telephone bill. I believe the only persons who will not appreciate this innovation will be the messenger boys, who will not be called so often."

And then Mr. Hill smiled a good-by and went back to his desk and telephone, across which he can look into the heart of a wood fire in his fireplace and dream and plan more things to bring the world closer together.

Telephone Investigation.

U. N. Bethell, president of the New York Telephone Company, was recalled to the witness stand at the session of legislative investigation of telephone and telegraph conditions in New York state on Saturday, February 26, and was closely questioned as to the efforts of the New York Telephone Company to prevent local competition.

Mr. Page asked Mr. Bethell if his company had not used all possible legal and lawful methods to prevent independents from entering New York city, and in reply the witness declared that in the opinion of the telephone interests controlling the conduits of the city the outsiders were not legally authorized to operate.

There are still a number of suits and injunctions pending between the local interests and would-be competitors.

Relative to the purchase of the New York Company by the American Telephone and Telegraph Company in September, 1909, Mr. Bethell stated that there were 162,000 New York Company shares owned by the Western Union Telegraph Company, for which the telephone company paid about $24,000,000.

When the New York Telephone Company increased its stock about $36,000,000 last year, the American Telephone and Telegraph Company purchased the entire amount at $140 per share. The property was also mortgaged for $75,000,000, of which bonds $25,000,000 were sold. By these two deals, the New York company enriched its treasury to the extent of $72,000,000. This sum was used to take over the New York and New Jersey Telephone Company on the basis of $142 a share and the Bell of Buffalo at $93.50.

According to President Bethell, the assets of the New York company, including those of subsidiary companies, total $196,592,950, this sum representing actual value of plant, with nothing allowed for franchises, patents, etc.

Amos Emerson Dolbear.

Prof. Amos Emerson Dolbear died at his home at Tufts College, Medford, Mass., on the afternoon of Wednesday, February 23.

Prof. Dolbear was seventy-four years old and was born at Norwich, Conn. His father died when he was two years old, and he was taken by his mother to Newport, R. I., where he studied in the public schools until his mother's death, which occurred when he was ten years old. After that he sought employment on a farm in New Hampshire, subsequently working in a shipyard, printing office and fire-arms works. At the age of eighteen he traveled to Missouri, where he became the master of a small school at Hartswell. He later returned to Rhode Island, later on securing work at Taunton, Mass., in a machine shop. Here his health broke down, and after a short experience at the Springfield Armory he determined that it was necessary for him to secure a better education and fit himself as a teacher. He enterd the Ohio Wesleyan University, graduating in 1866 after spending less than two years in the course, and having supported himself entirely by his own exertions. After graduating he went to Michigan University to study chemistry, and after six weeks was appointed assistant instructor in that department. At the end of the year he was placed at the head of a geological exploring expedition around Lake Superior, and after his return the University conferred upon him the degree of Master of Arts and Mechanical Engineer. He became assistant professor of natural history at Kentucky University, and at the end of the year became professor of physics and chemistry in Bethany College. He was elected mayor of Bethany, West Virginia, in 1871 and 1872, and in 1874 accepted the chair of physics and astronomy at Tufts College.

Prof. Dolbear occupied a unique position in the scientific world. For the last thirty years there has rarely been a subject related to physics and pure and applied science upon which Dolbear has not placed some anticipatory suggestion or discovery. He was a pioneer in the research work which Hertz later developed in his researches upon oscillatory motion. He anticipated Roentgen's great discovery of the X-ray, and announced the discovery of wireless communication, brilliantly developed by Marconi, many years before the Italian inventor startled the world. He was probably celebrated for his work in telephony and telegraphy more than any other single man, and always claimed that he was the original discoverer of the telephone. In fact, it would appear from the catalogue of his inventions and discoveries that, excepting Mr. Edison, he initiated a greater number of electrical discoveries and inventions than any other man. But it is no disparagement to his brilliancy in his experiments in electrical phenomena that he was not gifted with a keen commercial sense, and in many instances he was unfortunate in his selection of those who undertook the exploitation of his inventions, receiving from them small amounts, probably far less than his expense in these matters. He was a prolific contributor to the scientific press and the author of several standard scientific works. He was a fellow of the American Academy of Arts and Sciences, and of the American Association for the Advancement of Science, and a member of the Twentieth Century Club. He received a silver medal from the Paris Exposition, and a gold medal from the Crystal Palace Exposition in London in 1882. He was one of the examiners of the electrical section at the World's Fair in Philadelphia, and also at the World's Fair in Chicago. He was elected to the Carnegie Institute, when he was made professor emeritus of physics at Tufts in 1906, his retirement from active service being necessitated by ill health.

He was married in August, 1860, to Miss Alice J. Hood. They had six children, of whom three sons and two daughters are living. They are Benjamin L., a senior at Tufts College: Clinton E. and Samuel H., at present in California; Miss Catherine and Miss Mary, both in St. Louis. He is also survived by his widow.

Speed of Electric Locomotive Demonstrated.

The new electric freight locomotive of the New York, New Haven & Hartford Railroad Company, hauling thirty loaded cars, a heavy freight engine and a caboose, attained a speed of fifty miles an hour on a test run from New Rochelle to Stamford recently.

The run was made in a drizzle of rain which froze as fast as it fell on the tracks, making them very slippery.

McCall Ferry Power Suit.

In the suit of the Knickerbocker Trust Company against the McCall Ferry Power Company upon filing the report of Henry T. Brown, special master appointed by the United States Circuit Court and the report of J. E. Aldred, as receiver, Judge Lacombe made an order discharging the special master and releasing his bond.

Special Master Brown made a sale of the McCall Ferry Power Company's plant and other assets to William N. Barnum for $2,139,443, which amount, less the legal expenses, was paid on $8,827,000 of bonds issued by the McCall Ferry Power Company, of which the Knickerbocker Trust Company was trustee. The receiver is directed by the court to apply $697,674 of the purchase money to paying the coupons due December 15, 1908, and June 15 and December 15, 1909, and the balance, $1,427,745, is to be applied to the principal of the bonds.

Southern Independent Telephone Association Meets.

The Southern Independent Telephone Association held its semi-annual meeting in Atlanta, beginning Wednesday, February 23, there being present at the opening session about thirty delegates representing the states of Georgia, South Carolina and Florida. Dr. J. G. Dean, of Dawson, Ga., is head of this association, the purpose of which is the mutual aiding and co-operation of all independent telephone operators, manufacturers and owners. L.

Special Street Illumination for West Madison Street, Chicago.

The merchants on West Madison Street, one of the most important business streets on the west side of Chicago, have started a movement to interest residents in that district in "home industries."

An important feature in this undertaking is the proposed installation of a special system of street illumination. Contracts have already been signed for 101 special street-lighting lamp posts to be erected at the curb line, each supporting four sixty-watt tungsten lamps in frosted globes. The posts are of iron and of ornamental design with the four white globes at the top.

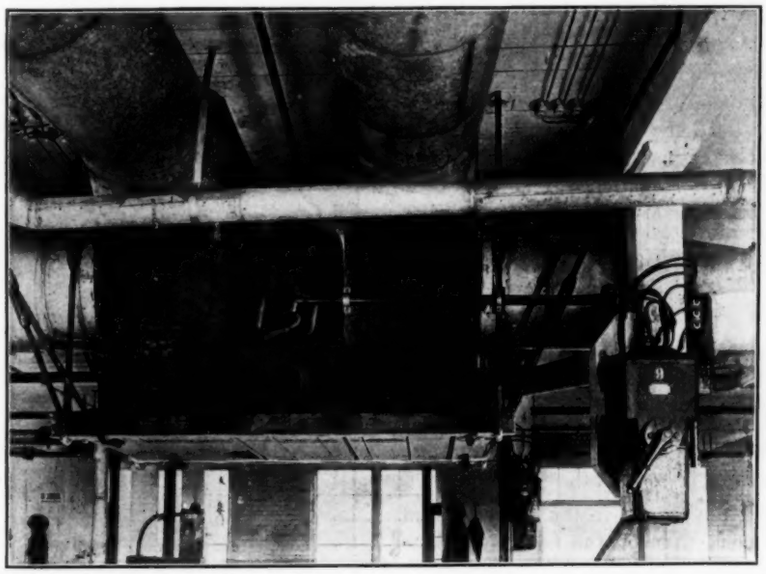
The service is to be furnished and maintained by the Commonwealth Edison Company, Chicago.

ELECTRIC DRIVE IN A LUMBER MILL.

AN UP-TO-DATE WOODWORKING ESTABLISHMENT.

The plant of the Franklin County Lumber Company (Mr. Gains, manager), situated in the beautiful old town of Greenfield, Mass., on the Green River, near the outlet of this stream into the Connecticut River, contains one of the best equipments of electrically driven woodworking machinery in a planing mill that can be found in the great little New England state of Massachusetts.

The mill has been running with the present equipment for about a year, although many of the woodworking machines were formerly used in the old steam-driven mill nearby, now used for storage purposes. The present mill is served by the same yards and the same dry kilns, but is in a separate two-story brick building with basement, and has a detached concrete building for shavings and sawdust, removed from the mill proper by, perhaps, twenty feet. Thus the fire risk is very greatly reduced by the general layout. "No Smoking Allowed, per order Fire Insurance Co." signs are posted conspicuously, and an automatic sprinkling system is installed, so that every precaution has been taken.

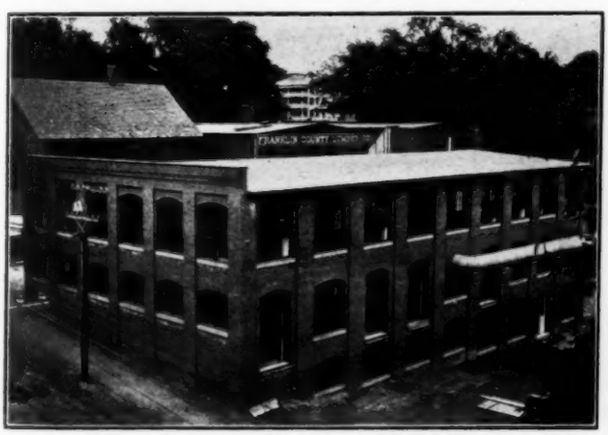


BLOWERS FOR DUST AND SHAVINGS CONVEYOR, DIRECT-CONNECTED TO ALTERNATING-CURRENT MOTOR.

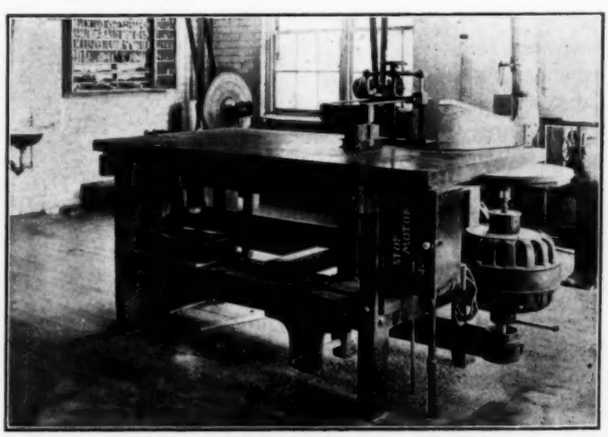
The machines are equipped with individual sixty-cycle, three-phase, 220-volt Westinghouse motors, mainly of the squirrel-cage type. Power is supplied from the circuits of the Greenfield Electric Light and Power Company at 2,300 volts, but is stepped down by three fifty-kilowatt transformers and distributed through the mill at 220 volts. Grounded gas-pipe conduit is used throughout the mill for the wires, and all fuses and starting switches are inclosed in tin boxes. The wires enter the building in the basement through a three-phase cable in an iron pipe, running down the pole and into the ground, and lead through a high-tension circuit breaker and panel to the primaries of the three delta-connected transformers, and from the secondaries, also connected in delta, the cables run to a distributing panel with meter, switches and fuses. These are all located in a fireproof room of brick and concrete, without wood except a small rack in front of the board to stand on. This room, called "the tomb," is regularly kept locked, so that no idle curiosity can lead anyone into danger.

The secondaries of the transformers are fused inside the delta connections, and the seven separate branch circuits are also fused inside the tomb. These branch circuits run outside to distributing boxes from which the circuits run to the individual motors. The motor circuits are all fused at this point, and again at the starting switch.

The wiring is all done in a remarkably neat and workmanlike manner, and reflects much credit upon the contractor, L. M. Willard of Keene, N. H., who had charge of the entire layout. He is to be commended for the thoughtfulness in providing in "the tomb," by the switchboard, a list of the circuits and the proper fuses to be used in each



EXTERIOR VIEW OF PLANING MILL SHOWING TRANSMISSION WIRES AND SHAVING-COLLECTOR SYSTEM.



SINGLE-SPINDLE SHAPER DRIVEN BY VERTICAL WESTINGHOUSE TYPE "CCL" MOTOR.

and a list of the motors from each circuit. It is to be noted that each motor starting box has its own number, which applies to the motor as well. Thus it is possible for even a new man to trace the circuits with perfect ease. Too often a wireman leaves a maze of wires without any trail whatever, so that the difficulties of tracing out the circuits when a fuse blows are greatly multiplied.

In addition to these conveniences a 220-volt lamp with special handles for hooking on to a circuit is also provided to permit ready determination of the location of a blown fuse.

The work done in the mill is of a general jobbing nature for inside and outside house furnishings as well as some cabinet work, so that pine (hard and soft) hemlock and cypress constitute the greater part of the material worked, though some brown ash, oak and birch are run through in small lots.

The motors are, in the main, located elsewhere than on the floor, as on the side wall or a post or the ceiling, or on the ceiling below and belted up through the floor. Where motors are on the floor, together with belts, they have been boxed in, with allowance for ventilation, by a screen; thus they are protected both from dirt and off-fall, and guarded against accident. The motors mounted on the wall where the belts protrude into the passageway, are also equipped with boxes for the belts.

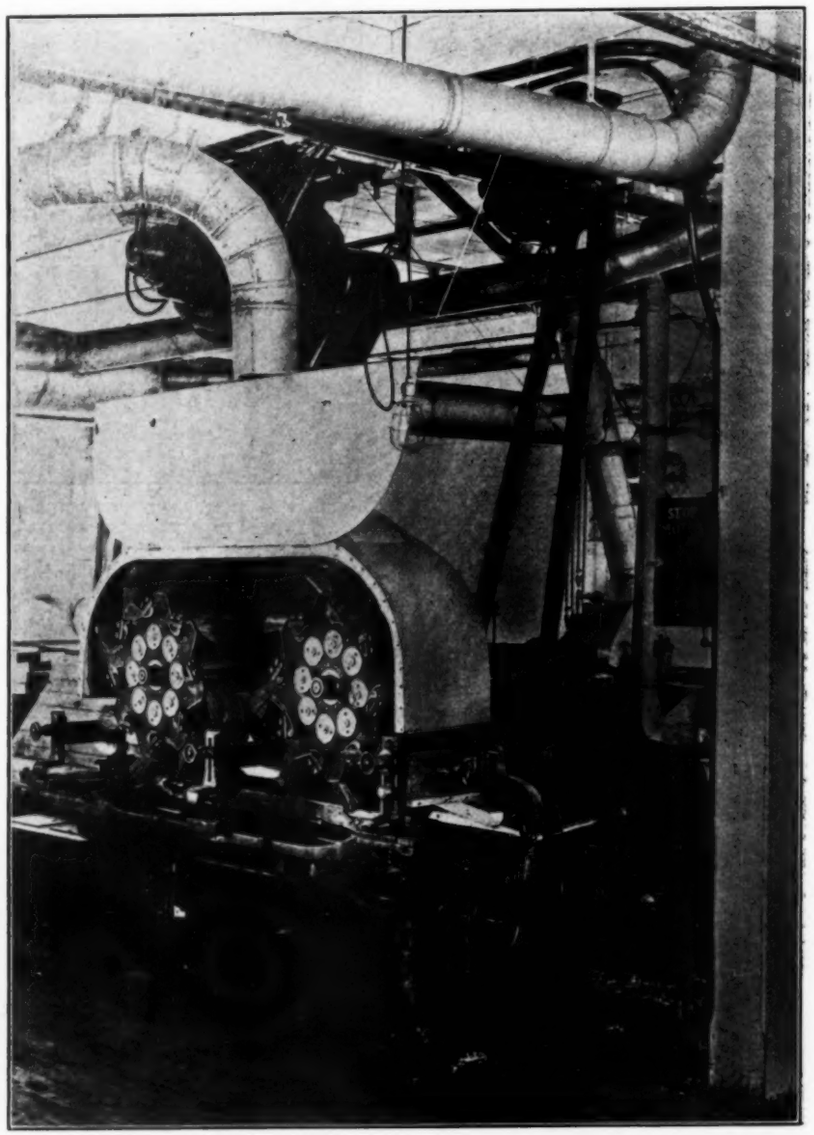
There are employed, in addition to a foreman and a steam engineer to run the dry kilns, shaving baler and kindling saw, three or four benchmen and seven to ten machinemen, according to the amount of work going through.

The machines are piped with individual sawdust collectors, and the entire exhaust system supplied from a double thirty-inch blower with fans direct connected to the extended motor shaft. The housing is mounted on a platform suspended by iron bars from the ceiling of the first floor, which makes the piping as short as possible, as there is but one outlet in the basement. The shavings are carried by collector across a roadway to the cyclone on the top of the shavings building in which are separate rooms for sawdust and shavings, with chutes on the ground floor for delivery into wagons or for delivering the shavings to the baling press located on the ground floor. This baling press, made by Dederick and Sons of Albany, makes two bales at a time, thirty by sixteen by sixteen inches, a convenient size for handling. It is driven through a countershaft, necessary for reversing, by a 7.5-horsepower squirrel-cage motor with a two-point auto-starter. The motor has no moving contacts, and the starting contacts are all under oil. There are no lights in the building and the main construction is of concrete, so that the possibility of fire is thereby reduced to the minimum.

Shavings and refuse are used under the low-pressure boilers for the dry kilns and for heating when required, but considerable revenue is obtained from the sale of loose and baled shavings, in fact almost enough to pay for the full power bill of the entire factory.

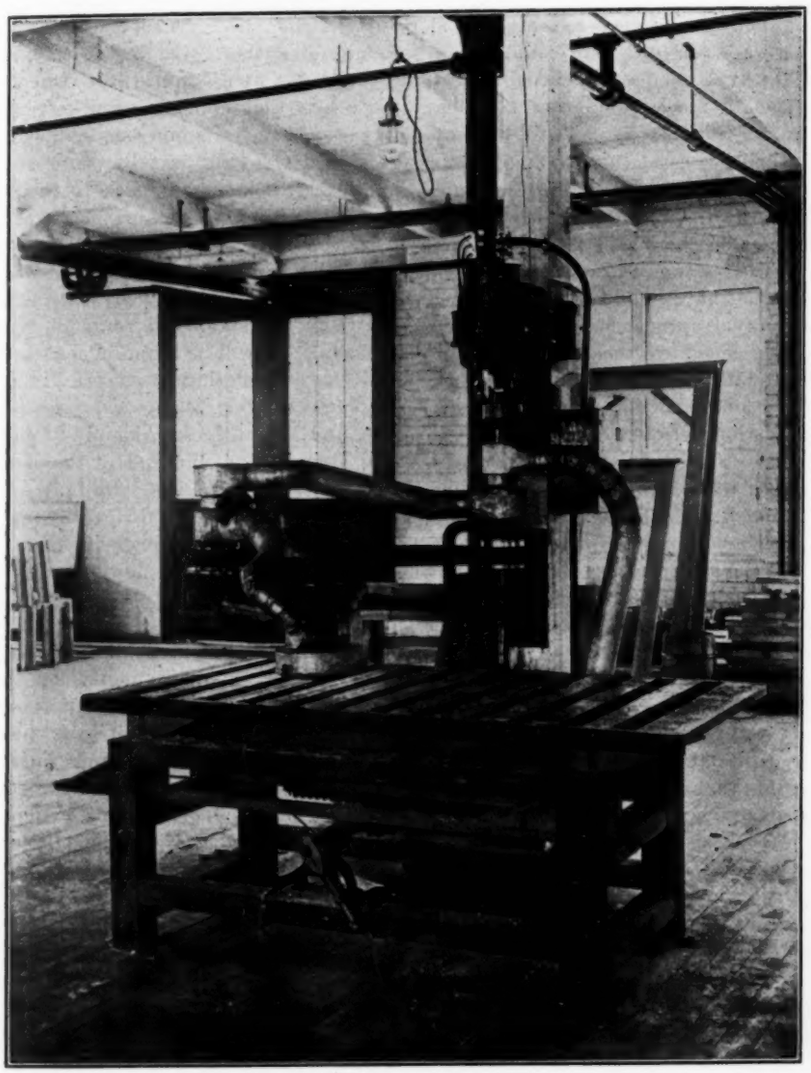
All motors over five horsepower are started by a standard two-point auto-starter, of Westinghouse make, with the exception of the two wound-secondary motors which are equipped with regular external resistance type of starter. All motors of five horsepower and below are started from a three-pole, double-throw switch, wired without fuses for starting but with fuses on the running side.

The mill equipment is shown in a table (to be given in a later issue) where the machines and drives are all specified. Two vertical motors are included; one on the column sander, thus eliminating a quarter-turn belt, and the second on the single-spindle shaper.



SPECIAL MOLDING SANDER WITH COVER RAISED TO SHOW SANDING BRUSHES.

This motor was originally intended to be belted directly to the shaper spindle, but it was found that there was insufficient room below the table to bring the motor and spindle pulleys in line, so the motor was mounted below the table and belted to a vertical countershaft, and from it to the spindle. The other motors are all standard floor-



POST SANDER. DRIVEN BY VERTICAL MOTOR COUPLED TO VERTICAL SHAFT.

type motors mounted on floor, wall or ceiling as desired.

The total installed motor horsepower aggregates 231, and the working time, nine hours a day with Saturday half-holiday in summer, amounts to about 225 hours per month.

The load factor of the plant is but thirteen per cent so that the kilowatt-thirteen per cent so that the kilow- the produce of the total installed motor capacity and the number of hours worked. The energy consumed has averaged approximately 6,600 kilowatt-hours per month, a large share of this being due to the blower. The latter runs continuously nearly loaded although gates are installed at each machine, and a notice printed at each which acts as a constant reminder, "Close Gate." And again, on each motor switch-box are lettered the words "Stop Motor," so that each operator has a constant suggestion that the realization of the advantage of intermittent operation are up to him.

Indirect Advertising.

The Meridian Light and Railway Company, Meridian, Miss., is striving to educate the public in the various applications and benefits of electricity by having published each day in the daily papers an article dealing with the rapid development of electricity.

An Electromagnetic Compass.

The *Journal de Physique* for November contains a description of an electromagnetic compass suitable for use on board ironclads, which was described before the *Societe francaise de Physique* more than a year ago by the inventor, M. Louis Dunoyer, and has now been tested on board one of the French cruisers. The apparatus, says *Nature*, consists of a solenoid wound with two wires in parallel, which can be rotated at a constant speed about a vertical axis to which its own axis is perpendicular. The ends of each of the two wires are connected to a two-part commutator on the axis of rotation, and the two pairs of brushes bearing on the commutators are set at right angles to each other. From the brushes wires lead to the coils of two moving coil galvanometers. The coils move about horizontal axles at right angles to each other, and mirrors attached to them produce images of two lines of light on a horizontal ground-glass screen. As the solenoid rotates the mean currents through the galvanometer coils are proportional to the sine and cosine of the angle between the axis of the ship and the horizontal component of the earth's magnetic field, and the line joining the crossing points of the two images to the center of the screen gives the direction and magnitude of that component.

The apparatus allows of ready compensation for both permanent and temporary magnetism of the ship. As the ship is "swung" the crossing point of the lines of light describes on the glass screen an ellipse, the axis major of which will, in general, be inclined to the direction of motion of both the galvanometer coils. By rotating the solenoid with respect to the commutators, the axis may be made to coincide with one of these directions. It is then only necessary to add resistance to the circuit of the coil which gives the larger deflection to reduce the ellipse to a circle, which would be the figure obtained if the earth's magnetic field were undisturbed by the vessel. The method is evidently very flexible, and admits of the observations being taken in the cabin while the rotating solenoid is placed

Electrical Installation for Hungarian Coal Mines.

A contract has been let for a 2,000-horsepower electric-generating station to furnish current for lighting and power to the State coal mines at Petroszény, Hungary.

REASONABLE DISCRIMINATION.

BY ALTON D. ADAMS.

Discrimination in public service rates is often legal and reasonable. As stated by the United States Supreme Court:

"Of course, such equality of right does not prevent differences in the modes and kinds of service, and different charges based thereon. There is no cast-iron line of uniformity which prevents a charge from being above or below a particular sum, or requires that the service shall be exactly along the same lines."

This rule is illustrated by many cases both as to differences in rates and in service.

Under a statute which provided that every person within a certain area was "entitled under similar circumstances to a corresponding supply," an electric consumer that used his lamps at night was charged more per kilowatt-hour than a consumer that used his lamps during the day. This discrimination was upheld by the court which said:

"Moreover, he is a consumer who burns largely upon the day load as distinguished from the night load—a circumstance which is to these companies of great importance. They are bound to keep their plants running in the day as well as in the night, to some extent at least, because some consumers want current during the day; and to get a consumer who draws on the day load is of use to them, because they are getting some return for running the plants during hours which would otherwise be unproductive. May they take that into consideration? I answer, certainly they may. The 'circumstances' are not 'similar' where the one consumer is on the day load and another is on the night load."

On a principle similar to the above, a rate that amounted to 5.95 cents per kilowatt-hour for street lighting has been fixed by a commission, where the rate to small consumers was fifteen cents per kilowatt-hour. In another case, a rate that amounted to 7.7 cents per kilwatt-hour was fixed for street lighting where the maximum rate for commercial lighting was twenty cents.

Where an electric lighting company sold power to a street railway at a rate much below that to private consumers, it was said by the commission that low rates to a railway might enable a company to supply its other customers with increased economy and satisfaction.

As to the general supply of electric power it has been held that:

"Electric power for general purposes must be supplied, if at all, in competition to a certain extent with other kinds of power, particularly steam power, and this fact cannot be overlooked in fixing rates for such services. Under certain conditions it is not unlikely that such power may be supplied at a less rate per unit than could be applied to the company's entire output, and yet to the advantage of the company and its customers as well."

In another case where the supply of electric power by a lighting company to a railway at a low rate was attacked, the commissioners said that the supply of power to the railway imposed no additional burden on the towns served, and that advantages had accrued to the lighting company from the varied character of its business.

The same principle that justifies discrimination between consumers on the day load and those on the night load, between street lighting and other lighting, and between light and power supply, obviously permits a higher charge to the consumer whose demand comes at the hour of peak load than to the consumer whose demand comes at other times.

In one jurisdiction, the court having held that it was unlawful to supply electricity for power or heating at a lower rate than for lighting, under a statute that required a "uniform" charge, the legislature thereupon enacted that it should be lawful to supply electricity for power or heating at a less rate than for lighting. Under this same statute that required a "uniform" charge and that no "preference" be shown to any person, it was contended that it was illegal to sell electricity at a "maximum demand rate" of fourteen cents per kilowatt-hour for the first forty-five hours' use of the maximum demand of a consumer in any month, and a rate of four cents per kilowatt-hour for all excess in that month, besides selling at the flat rate of nine cents per kilowatt-hour to all who desired a supply on that basis. The court upheld the validity of this system of optional rates, and said of the statute that:

"The 'preference' prohibited in substance by it is 'a preference' between customers dealing under similar circumstances, and not between customers dealing under two different systems of supply, either of which they are free to select.

As to the right to discriminate between the rates to large and small consumers merely on the basis of the amount of service rendered there is a strong conflict of authority among the courts, but if it can be shown that the larger service is rendered in such a way as to reduce the cost per unit, the weight of authority is that it may be charged for at a lower rate. One of the courts that upholds lower rates to larger consumers, simply as such, has expressed the rule as follows:

"Surely, it cannot be said to be unreasonable to provide less rates where a large amount of water is used than where a small quantity is consumed. That principle is usually present in all contracts or established rents of that character. It will be found in contracts and charges relating to electric lights, gas, private water companies, and the like, and is a business principle of general application. We find in the rates as they were established nothing unreasonable, or that would in any way justify a court interfering with them."

An example of the lower rates to large consumers that are upheld where the service involves less cost per unit is the freight per carload compared with that per hundred pounds on the railroads. In a case where the rates on oil were in controversy, it was held that a rate per hundred pounds in less than carload lots twice as great as the rate per hundred in carloads was not unreasonable. There is conflict of authority as to whether the shipper of train loads should have a lower rate than the shipper of carloads.

If a consumer furnishes a part of the equipment necessary to serve him he may be given a lower rate than others. Thus on the railways a shipper who provides terminals may have a lower rate, and so again may a shipper who furnishes his own cars. This principle has an important electrical application where transmitted power is sold in large units to some consumers who provide substations, and to others who do not. It is reasonable discrimination to give consumers who provide substations lower rates. So, too, it has been held that an electric light company may refuse to supply a consumer with electricity unless he provides or pays for a transformer to reduce the pressure at his house.

Where a gas consumer used gas to the amount of only $1.75 per year, it was held that the gas company might discriminate against him by refusing a further supply unless he agreed to pay a meter rent, though no such rent was charged to other consumers, on the ground that the small use of gas by this consumer made his case exceptional.

If gas or electric consumers take service during only a part of each year, as at summer resorts, it is the practice in some instances to charge them higher rates than consumers who take service the entire year. This discrimination appears to be supported by decisions that water supply companies may refuse to deliver water at less than the rate for three months or other substantial period. Somewhat similar cases of discrimination that are upheld are the five-cent fare for short distances on electric railways, and the charge of the one-hundred-pound rate on less than one hundred pounds of freight by steam roads.

Where consumers agree to accept a service limited as to the hours of the day, it is the practice in some places to give them an especially low rate. Thus in one city a manufacturing plant with more than 3,000 horsepower of motors connected to the electrical supply lines was given a rate of less than 0.6 cent per kilowatt-hour with the proviso that energy should not be furnished after 4 p. m. of each day, during the months of heavy lighting. In another city, the power rates to large consumers are about one cent per kilowatt-hour, provided that there is an agreement not to use current at the peak of the central-station load during five months in the year. Similar discriminations are sometimes made in favor of battery-charging during the latter half of the night.

These discriminations in favor of consumers who contract for a restricted service may be supported as reasonable by the same line of cases that warrant lower rates for street than for commercial lighting, and for the day load than the night load.

In street lighting and perhaps in some other lines of electrical supply, where a large and distinct part of the electric plant is devoted to a particular class of work, it is a frequent practice to offer lower rates to cities or persons that make long term contracts, on the ground that depreciation might be a larger item with no contract or one covering only a short period. Support for this sort of discrimination can be found in numerous cases, but there is conflict of authority on the point. One company that supplies street lighting in a number of cities and towns allows a discount of one per cent a year up to twenty years from the maximum rates, if a contract covering a term of years is made.

Discrimination in public service rates favorable to consumers who contract to relieve the company from liability for damages that may result from its negligence has been sanctioned in a number of cases, but there is much disagreement among the decisions as to the extent to which such contracts may go. In certain lines of electrical work where the damages resulting from failure of current might be great, the right to contract against liability is valuable to an electrical supply company.

In the face of competition, some courts have sanctioned discrimination in favor of a consumer who deals exclusively with a single company, but the majority of the decisions are the other way.

Competition, however, has been held to justify lower rates in one city than in another, where both places were served by the same corporation, and there was competition in one of the cities. In a decision on this point the United States Supreme Court has said:

"But, since the ruling of the Commission was made in this case, it has been settled by this court that competition which is controlling on traffic and rates produced in and of itself a dissimilarity of circumstances and conditions described in the statute, and that where this condition exists a carrier has a right of its own to taking it into view in fixing rates to the competitive point."

With the extension of transmission systems to numerous cities and towns, the principle just stated may have very important applications.

The development of transmission systems for the sale of electrical energy only in bulk raises the question whether these systems can be compelled to serve ordinary consumers. While only a few decisions deal with this point, there is judicial authority for the conclusion that an electrical supply system may elect to serve only very large consumers.

One of the most disputed questions in the law of public service relates to the right to discriminate in favor of special lines of business or certain uses of the supply. On this point the courts are divided. In one case where the right to discriminate in this way was upheld the court said:

"And yet it is very certain that such discrimination does prevail, and has prevailed for a long time on all lines of railway and canal. It is highly probable that the absence of litigation upon such discrimination is due to the general sentiment of its fairness and justice."

By the weight of authority, a public supply cannot be demanded by those who intend to resell the product, as water, gas or electricity, in competition with the system that produces it.

The Design of Constant-Potential Transformers.

In the second part of the article on this subject that appeared in the issue of February 19, two typographical errors have been discovered as follows:

On page 384 the denominator in (9) should be

$$f\,(10^4\,\eta\,\beta^{1.6} + 1.645\,d^2\,f\,\beta^2)$$

instead of

$$f\,(10^4\,\eta\,\beta^{1.6} + 1.645\,d^2\,f^2\,\beta^2)$$

On page 385 equation (17) should be

$$I'_w = \frac{W_c}{E'}$$ instead of

$$I' = \frac{W_c}{E'}$$

Addition to Michigan Engineering Building.

Work has been progressing steadily all the fall and winter on the addition for the new engineering building at the University of Michigan, Ann Arbor, Mich. It is expected that the new rooms will be ready for occupancy near the beginning of the second semester.

It is estimated that this addition will enlarge the engineering building by at least one-third; 50,000 feet of floor space is added in the fifty-seven rooms provided by the extension. These rooms will be divided into eight laboratories, thirteen class rooms, and a large lecture room with a seating capacity of 350.

All the administration of the engineering department will be carried on in offices located in the new part of the building.

ANNUAL DINNER, AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

AWARD TO PROFESSOR ELIHU THOMSON OF THE FIRST EDISON MEDAL.

A large attendance of ladies and gentlemen welcomed Prof. Elihu Thomson at the Hotel Astor, Thursday evening, February 24. This was the occasion of the presentation to Professor Thomson of the Edison Medal, and previous to the presentation ceremonies an excellent banquet was served in the large and beautifully decorated banquet room of the hotel. Electrical decorations of a unique and very beautiful nature were prepared for the occasion by the New York Edison Company and the Edison Electric Illuminating Company of Brooklyn.

Before proceeding with the regular programme, Toastmaster Martin read the following telegram sent by Edison from Fort Myers, Fla.: "I appreciate deeply the honor that associates my name with the first medal established in the institute and awarded for achievement in electricity. I count myself also not less fortunate than the institute in the fact that the first recipient of this medal should be my friend Elihu Thomson. He is a man we all admire, alike for his work and for his personality. Long may our art and institute enjoy such services as his."

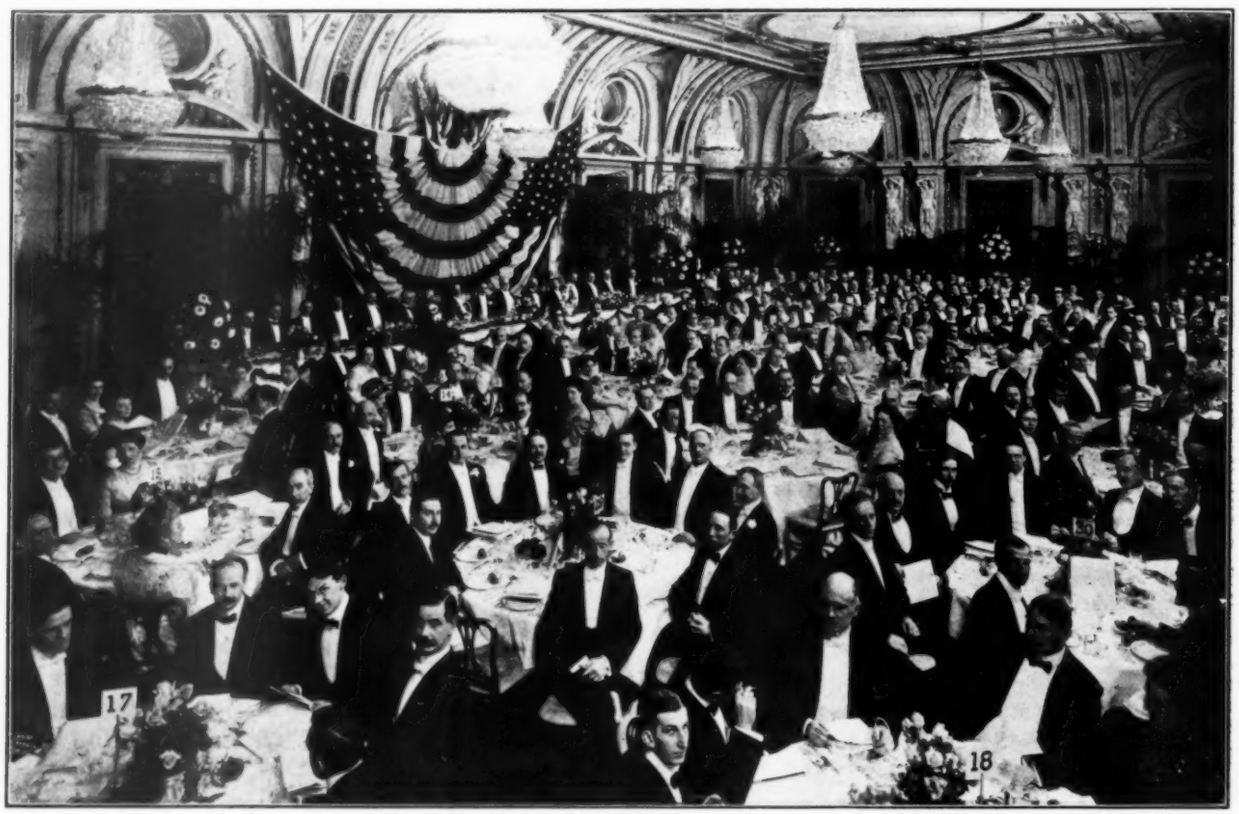
Other letters and telegrams were read, among them one from Chicago, signed by many of the old-time friends of both Mr. Edison and Professor Thomson, including Bernard E. Sunny and H. M. Byllesby.

President Lewis B. Stillwell welcomed the guests of the evening at the close of the dinner in a neat little speech which he prefaced by a most courteous and complimentary reference to the ladies present, who assisted in no small measure to make the annual dinners of the Institute the success that they were. Commenting on the change the dinners made in the appearance and utterance of the Institute members on these occasions, he said: "Conservation gives place to conversation; traction vacates the field in favor of attraction; and wireless signals are matters of course, though never commonplace." Continuing in a more serious vein, Mr. Stillwell reviewed briefly the scope of the work of the Institute in its various specialized branches, and proceeded to introduce T. Commerford Martin, former past president, as toastmaster for the evening.

Mr. Martin, taking for the subject of the first toast of the evening "Education and Invention," created some genuine merriment by his humorous references to himself as a "man with a past" which were occasioned by the congratulatory personal references of the previous speaker. He proceeded to read several telegrams, one of which, from Thomas A. Edison, is given above.

Mr. Martin then introduced Prof. Charles Baskerville, professor of chemistry of the College of the City of New York, who spoke as representative of Dr. John H. Finley, president of the same college, who was unfortunately absent through illness.

Professor Baskerville occasioned much laughter by several amusing anecdotes and stories. He made several complimentary references to Doctor Finley and created some applause by remarking that "after all the electrical engineer is only a subdivision of the applications of chemistry." The speaker



MEMBERS AND GUESTS AT ANNUAL DINNER OF AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

went on to discuss cursorily some of the more important aspects of hygienic, sanitary, and sociological problems of municipal communities, with special reference to the enormous expansion of the city of New York, which, he said, would have by the year 1920 a population of 7,000,000 if present indications were fulfilled.

Toastmaster Martin then introduced Samuel Insull, president of the Edison Medal Association.

Mr. Insull, who was recived with applause, made an address in response to the toast "Meritorious Achievements in Electricity." He spoke first in glowing terms of both Mr. Edison, in honor of whom the Edison Medal was founded, and of Professor Thomson, the first recipient of the distinction. Mr. Insull then reviewed the development of the land telegraph, the first great achievement in electrical engineering, and the later application of the same principle to submarine work. The telephone was then briefly noted, and next the development of electric lighting, in succession, by Jablochkoff, Brush, Thomson and Houston, Edison, Zippernowski, Bradley, Tesla, Stanley, and numerous others, especially George Westinghouse, who, by his development of the alternating-current system, has done so much to enable us to produce electric current on a large scale at low cost. (The reference to Mr. Westinghouse was received with loud applause.) Mr. Insull mentioned further, in passing, the storage battery, the wireless telegraph, Tesla's work in alternating-current apparatus, Lord Kelvin's work, Professor Weston's development of measuring instruments of precision, the still later development of the turbo-generator, and so forth. In conclusion he remarked speculatively that perhaps at some future time some members of the Institute might receive the medal for some electrochemical or other process of producing electricity directly from fuel.

Mr. Martin then introduced President Lewis B. Stillwell to speak to the toast "The Edison Medal."

President Stillwell proceeded to give an account of the origin of the Edison medal, and the object which the members of the Edison Medal Association had in view in creating it. He deprecated the American custom of regarding pecuniary profit as the only real and tangible prize to be attained by talent and industry. The Edison Medal, then, was to be regarded as "an honor which may well constitute, through the years to come, an incentive to ambition and a stimulus to earnest endeavor."

Charles L. Clarke, Chairman of the Institute Edison Medal Committee, then presented the certificate of award to Prof. Elihu Thomson.

President Stillwell spoke reminiscently of his early memories of Professor Thomson, which were when the speaker was connected with the Westinghouse Electric Company, at that time a keen competitor of the Thomson-Houston Company. He asseverated that Doctor Thomson's character and achievements, notwithstanding the rivalry between the two firms, were as highly respected at Pittsburg as they were at Lynn. After quoting a rival's specification of Doctor Thomson's character and attainments couched in most eulogistic terms, President Stillwell added further expressions of his own regard to the recipient of the medal and then proceeded to make official announcement of the award.

Professor Thomson replied feelingly in a speech in which he begged his hearers not to forget that there were associated with him in his work many faithful co-workers to whom was due a high tribute, inasmuch as they had "contributed in large measure to render possible that for which the Edison Medal has been so graciously accorded." He thanked the members with the utmost sincerity for the honor which they had accorded him.

The toastmaster made the concluding speech and before declaring the function closed mentioned that a copy of the medal in bronze would be shown around for inspection.

The Edison Medal Committee is composed of the following gentlemen: Charles L. Clarke (chairman), C. A. Adams, W. S. Barstow, Philip P. Barton, W. Hand Browne, Jr., John J. Carty, C. C. Chesney, H. E. Clifford, Dr. Gano Dunn, Louis A. Ferguson, B. Gherardi, George A. Hamilton, John W. Howell, Dugald C. Jackson, Charles E. Lucke, T. Commerford Martin, Ralph W. Pope, Samuel Reber, Charles F. Scott, Paul Spencer, Lewis Buckley Stillwell, Henry G. Stott, Charles A. Terry and J. G. White.

The Dinner Committee consisted of R. T. Lozier (chairman), Theodore Beran, Maurice Coster, Minor M. Davis, George A. Hamilton, F. L. Hutchinson, T. I. Jones, T. Commerford Martin, A. S. McAllister, William McClellan, Henry W. Pope, F. A. Scheffler, Samuel Sheldon, Albert Spies, Severn D. Sprong, J. G. White, Arthur Williams and George H. Guy (secretary).

The Reception Committee consisted of J. G. White (chairman), H. H. Barnes, Jr., Henry Floy, D. C. Jackson, J. W. Lieb, Jr., W. V. N. Powelson and Frank J. Sprague.

Among those in attendance were Mr. and Mrs. George Westinghouse, Charles A. Coffin, B. J. Arnold, E. D. Adams, Mr. and Mrs. W. S. Barstow, Prof. Elihu Thomson and wife, Joseph F. Becker, Theodore Beran, Charles Blizard, Mr. and Mrs. John Bottomley, Thomas B. Doolittle, H. W. Buck, Charles L. Clarke, Mr. and Mrs. H. S. Collette, Mr. and Mrs. F. E. Donohoe, Mr. and Mrs. W. W. Freeman, Dr. Gano Dunn, W. C. L. Eglin, Dudley Farrand, Mr. and Mrs. Henry Floy, Mr. and Mrs. N. W. Gage, Mr. and Mrs. F. W. Gay, Admiral C. F Goodrich, George H. Guy, Mr. and Mrs. E. N. Sanderson, Dr. Samuel Sheldon, Mr. and Mrs. F. H. Shepard, Albert Spies, Lieut. F. J. Sprague and wife, Mr. and Mrs. Jesse M. Smith, W. J. Hammer, Mr. and Mrs. Caryl D. Haskins, E. M. Herr, Samuel Insull, Mr. and Mrs. W. J. Jenks, E. F. Peck, Frank H. Gale, Charles W. Price, Mr. and Mrs. W. H. Kenyon, J. W. Lieb, Jr., R. T. Lozier, Paul Lupke, T. Commerford Martin, Mr. and Mrs. J. L. Meloon, Mr. and Mrs. Frederick Muschenheim, A. D. Page, H. W. Pope, Mr. and Mrs. R. W. Pope, Mr. and Mrs. E. W. Rice, Jr., C. Loomis Allen, A. L. Rohrer, Dr. George F. Sever, Mr. and Mrs. L. B. Stillwell, Henry G. Stott, Calvert Townley, Mr. and Mrs. George G. Ward, Dr. Schuyler S. Wheeler, Mr. and Mrs. James G. White, F. W. Willcox, Arthur Williams, Mr. and Mrs. Edward L. Young, E. H. Johnson, Mr. and Mrs. W. S. Andrews, W. K. Archbold, Frederick C. Bates, C. C. Chesney, Mr. and Mrs. Maurice Coster, W. K. Dunlap, Mr. and Mrs. Axel Ekstrom, G. E. Emmons, W. S Franklin, F. B. Herzog, E. W. Hill, Mr. and Mrs. E. R. Hill, C. W. Hunt, F. L. Hutchinson, Mr. and Mrs. D. C. Jackson, J. R. Lovejoy, E. H. Mather, A. D. Page, H. S. Putnam, F. A. Scheffler, Samuel Spalding, Jean R. Wagner, F. N. Waterman and Earl Wheeler.

Joint Meeting of the Western Society of Engineers, and Chicago Section, American Institute of Electrical Engineers.

A joint meeting of the Electrical Section of the Western Society of Engineers and of the Chicago Section, American Institute of Electrical Engineers, was held in the society rooms of the Western Society of Engineers, in Chicago, on Wednesday evening, February 23, 1910.

Prof. P. B. Woodworth, who presided at this meeting, introduced Edward N. Lake, of the Board of Supervising Engineers, Chicago, who delivered an interesting address on the subject of "Some Suggested Improvements in Underground Conduit Construction for Large Transmission Systems."

Mr. Lake's address may be divided into the following general heads: (1) general; (2) conduit construction; (3) manhole fittings; and (4) recommendations. Under the first head such various forms of conduit were described as the pump log type, Dorset asphaltic concrete forms, and the iron pipe and cement lined pipe conduits.

Upon entering the subject of suggested improvements, Mr. Lake said that they are all made with reference to the comparatively new ideas of isolation and protection of the cables for which the conduits are built, and that the precautions taken and the amounts expended for safeguards will depend entirely upon the importance that is attached to these matters by the men who are responsible for the designs and the expenditures.

Mr. Lake said that the best heat resisting and arc resisting material which is available on a commercial basis at this time is undoubtedly vitrified clay. In speaking of the qualities of this form of duct it was mentioned that where material is desired for use in contact with flame or intensely heated gases as in furnaces, boiler bridge walls, flue lining, etc.; where a receptacle is wanted in which to enclose a high-tension insulator, when it is placed in kilns where material is to be subjected to the intense heat of molten metals, or, in fact, everywhere that heat and flame are to be resisted by direct contact, some form of hard, burned clay is used.

The speaker referred to the explosive qualities of water when closely confined and exposed to sudden and intense heat, and said that due to this so-called explosive power of water, it is believed that the wall of a clay duct which might otherwise withstand the heat of a burn-out, will, if it contains a sufficient amount of moisture, be rapidly disintegrated. Hence, vitrified clay duct is best for large power distributing systems, which will absorb the smallest percentage of moisture.

Regarding conduit construction, the single and multiple duct was considered first, for telephone cables and for all cable systems where the number of heavy cables is not large and where no special consideration of the possible spread of "trouble" from one cable to another is thought to be necessary, the multiple duct on account of the economy of space and convenience in handling is the logical choice of vitrified clay duct. For systems which carry large groups of cable, where tens of thousands of kilowatts may be concentrated upon a burn-out and where cable separation and isolation must be given its due consideration, the single duct construction, according to the speaker, is believed to be better, and is most generally used.

The present standard single duct construction, using 3.25 or 3.5 inch square bore duct is believed to be the best engineering practice for large power systems at the present time. This construction, when properly installed, provides two walls of about five-eighths inch each of vitrified clay between adjacent ducts, and for ordinary burn-outs this is effective in isolating the trouble.

However, it is the opinion of Mr. Lake that in the case of a very severe burn-out there are certain weaknesses in this form of construction, one of these being due to the present form of the corners of the duct, which leaves a void of considerable size.

Another difficulty encountered in the present underground construction, according to Mr. Lake, is that unless very close supervision is exercised the joints in the duct will not be properly staggered as they are laid. The result of this is that burn-outs may occur in a duct which would affect the cables in the adjoining ducts.

Three plans for the improvement in staggering joints were submitted. The first plan consists of installing with the present singe duct in multiples with an extra separation of concrete between them. This construction, Mr. Lake said, does not overcome entirely the objection due to large voids at the corners, but it has the advantage of dividing up a conduit line into unit groups which are so thoroughly isolated that the possibility of a cable failure in one group injuring the cables in an adjoining group is very remote.

The next plan submitted is that known as "standard single duct." For a conduit section of tiers of four ducts in width this form is effective, as it is so arranged that joints in adjacent ducts will not be nearer than a quarter of the standard length or 4.5 inches apart.

Another plan was a modification of the former in which the multiples are in longitudinal tiers. Each tier is separated by a substantial layer of concrete. This form as described is a little more simple in construction, since the layer of concrete between tiers can be spread wet enough to make tamping unnecessary, and no "spading" is required.

Comparative figures based as nearly as possible upon similar conditions were presented by Mr. Lake to show the relative costs in cents per duct foot of the three different methods of conduit construction. For standard single duct the average is 17.6 cents. For single ducts in multiples 18.96 cents, and for single duct in tiers 18.68 cents.

Square bore duct has come into general use because two or more cables can be installed with greater ease than in a round bore. Mr. Lake said that round bore duct of the same size takes less clay to make, is lighter in weight, and there is less waste due to swelled ends in the drying process; also, there are fewer culls from the kilns because the shape is such that when piled for burning the heat is distributed more uniformally, and the material is therefore better burned and better vitrified.

For high tension lines and for important low tension lines involving large amounts of power where a superior construction is desired a line consisting of round bore, single ducts laid in tiers, with an extra space between horizontal ducts, would represent, in Mr. Lake's opinion, the very highest type of construction possible at this date. A comparative estimate of the cost of this construction and the present standard square duct construction, assuming identical conditions, and taking only the six-duct and twelve-duct

sections, was given as follows: Standard square bore per duct foot twenty-two cents; round bore special twenty-three cents, the extra cost of the round bore being therefore one cent. This small additional cost, Mr. Lake said, would often be more than justified on important lines of large systems.

In order to secure in a large measure the advantages of two separate runs with but little increase in the cost, Mr. Lake recommended what is styled the duplex construction, which consists in dividing the conduit in a run into two sections separated by a substantial barrier of concrete. The additional expense involved for this construction Mr. Lake said amounts to about 0.5 per cent per duct foot on a twenty-four duct line.

The question of laterals was given considerable discussion by the speaker, who described the iron pipe, sewer pipe, tile duct and fibre types. The total cost of each type of lateral was given by Mr. Lake as being: iron pipe only $13.49; sewer pipe, $11.95; tile duct, $11.25; iron pipe and fibre, $11.36. In all these styles the cost of the insulated pipes are from 11.4 to 16.7 per cent less than the uninsulated.

Likewise, the subject of manhole fittings was discussed and the different types in use fully described. The fireproof shelf construction is believed by Mr. Lake to be less expensive, more flexible, and the metal parts are entirely covered with cement, so that it is a combined shelf and barrier. Cables are thus separated into groups by a horizontal barrier of fireproof materials.

For a large group of more important cables the split duct construction in addition to the re-enforced cement shelves can be used advantageously, according to Mr. Lake. The four different forms of split duct which are available for this style of construction were described and the advantages and disadvantages of each discussed.

In conclusion Mr. Lake made the following recommendations to apply for any new underground conduit construction in any large distributing system: (1) Make absorptive tests upon the ducts and include an absorption requirement in the duct specified. (2) Use square bore, single duct for the standard construction. (3) Enforce a rigid adherence to a definite plan of staggering the joints. (4) Have all voids between ducts, especially at corners, thoroughly filled with mortar and concrete. (5) Order all future ducts with outside corners made on not greater than a quarter-inch radius. (6) Install present form of duct in longitudinal tiers, separated by a substantial layer of concrete for important lines. (7) For extra important lines or high tension lines install round bore duct with horizontal and vertical concrete separation. (8) Construct all lines of sixteen ducts or more in the duplex form. (9) For laterals use fibre protected with iron pipe on the vertical run up the pole, and protected with concrete at the bend and on the horizontal run. (10) In manholes use re-enforced shelf barriers for small groups of cables of minor importance. For larger groups of important cables use the split duct in addition to the shelves.

The discussion was opened by D. W. Roper, assistant to the chief operator of the Commonwealth Edison Company, who said that in regard to Mr. Lake's statement that vitrified clay was the best arc and heat resisting material, the experience of the Commonwealth Edison Company has been the opposite, similar burn-outs in concrete and clay conduits resulting in the former construction being unharmed, while in many instances the latter was completely destroyed.

Taking a specific example, Mr. Roper explained how, after a burn-out near one of the manholes in which the construction of the conduit to the manhole was of concrete pipe, and the joints in the manhole covered with split tile, the concrete ducts showed no bad effects from the burn-out, while on the other hand the tile was badly affected. In this case, although the defective cable burned for a distance of twenty-five feet, none of the other cables were damaged in any way. Other similar experiences were mentioned.

Regarding Mr. Lake's statement that ducts free from moisture were desirable on account of the disintegrating effect of this moisture when acted upon by heat, Mr. Roper said that clay conduit free from moisture was also desirable from the opposite point of view, as a damp conduit has a tendency to freeze in cold weather. A case was cited in which a conduit laid near a defective sewer pipe was badly affected from this cause.

Regarding the single duct in tier construction, as recommended by Mr. Lake, Mr. Roper said that this type of construction was not practical. He was of the opinion that in laying a layer of ducts on a three-inch foundation of concrete, then a one-inch layer of concrete and another layer of ducts, the workmen would walk over the ducts before the concrete was sufficiently dry, and would in this manner destroy any attempt at alinement. The disadvantages and inconvenience of poor alinement were mentioned by Mr. Roper, and he gave illustrations of the troubles encountered by the Commonwealth Edison Company in this respect.

Referring to Mr. Lake's recommendation relative to using round bore ducts for important lines, Mr. Roper said that when pulling two or more cables through ducts of this construction, owing to the twisting of rope, much inconvenience is encountered. Mr. Roper also spoke of the difficulty in drawing two or more cables through fibre-lined laterals.

W. B. Jackson, of D. C. & W. B. Jackson, consulting engineers, asked Mr. Roper if it was the usual custom to draw several cables through one lateral. Mr. Roper in replying said that in sixty-cycle installations they installed as many as four cables in one lateral.

Mr. Barrett of the McRoy Clay Works asked Mr. Roper if the condition of the surrounding cables in the burn-out he referred to would have been different if tile ducts instead of concrete had been used. In replying to this Mr. Roper said that if tile had been used, according to previous experience of the Commonwealth Edison Company, all cables would have been badly burned.

F. W. Darling, Clay Products Company, while not entering into the discussion of the paper, said that he represented one of the manufacturers who Mr. Lake communicated with in regard to smaller radii of clay conduit. He said since replying to Mr. Lake's inquiry the company had experimented with this form of duct and found that it could be manufactured successfully at the same price as former types. He said further that while the appearance of this new type might lead one to believe that it was unfit for use, the defections were entirely on the surface, and the interior remained as smooth and free from flaws as standard types.

CENTRAL-STATION PRACTICE

Transmission—Interior Wiring.

NEW POWER PLANT OF THE MERCHANTS HEAT AND LIGHT COMPANY, INDIANAPOLIS.

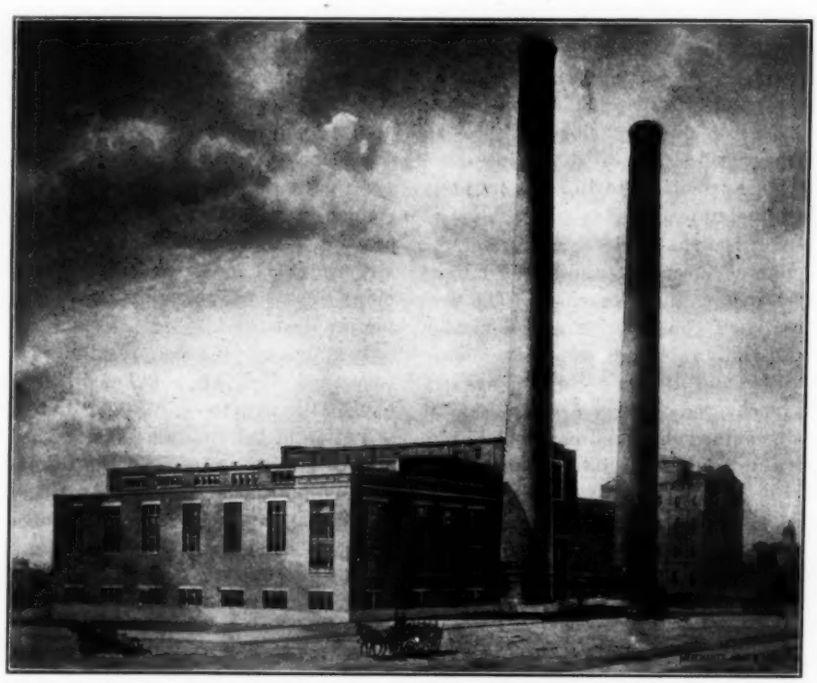
AN INTERESTING DESCRIPTION OF A MODERN CENTRAL STATION.

The Merchants Heat and Light Company was organized about 1901 by leading retail merchants of Indianapolis to supply heat and light to their stores. The present directorate of this company consists of the following retail merchants who were interested in the organization of the company: Edw. L. McKee (President), H. P. Wasson, Henry Kahn, C. A. Efreymson, Charles Mayer, Fred L. Ayers.

There were several reasons which led to this combine, among which was the elimination of the smoke nuisance from the stacks of the various individual power plants in the buildings of the members of the organization; another was to give the stores a larger place for storage in their basements, which, at this time, were occupied by their heating and lighting apparatus; and further, the possibility of obtaining light, heat and power from the same company with a possibility of reduction in price for these utilities when covered by one contract.

When the organization began its construction it was with no idea of the development of the business beyond possibly a dozen customers. However, before the actual construction work was well under way other merchants approached the company with a view to supplying them with heat, light and power from the new station. It was, therefore decided to make the apparatus for the first installation somewhat larger than at first contemplated to take care of the small number of additional customers. However, after operation had actually started, the success of the enterprise was so apparent, and the growth of new customers so rapid, that in a very short time additional apparatus had to be installed to take care of the requirements. From that time on the growth has been constant and has practically been limited only by the capacity of the apparatus installed.

When the project was first started the capacity of the station as built was relatively so small that the question as to whether the plant would be condensing or noncondensing was of minor importance, and therefore a site was selected which was adjacent to what might be called the "center of gravity" of the business district.

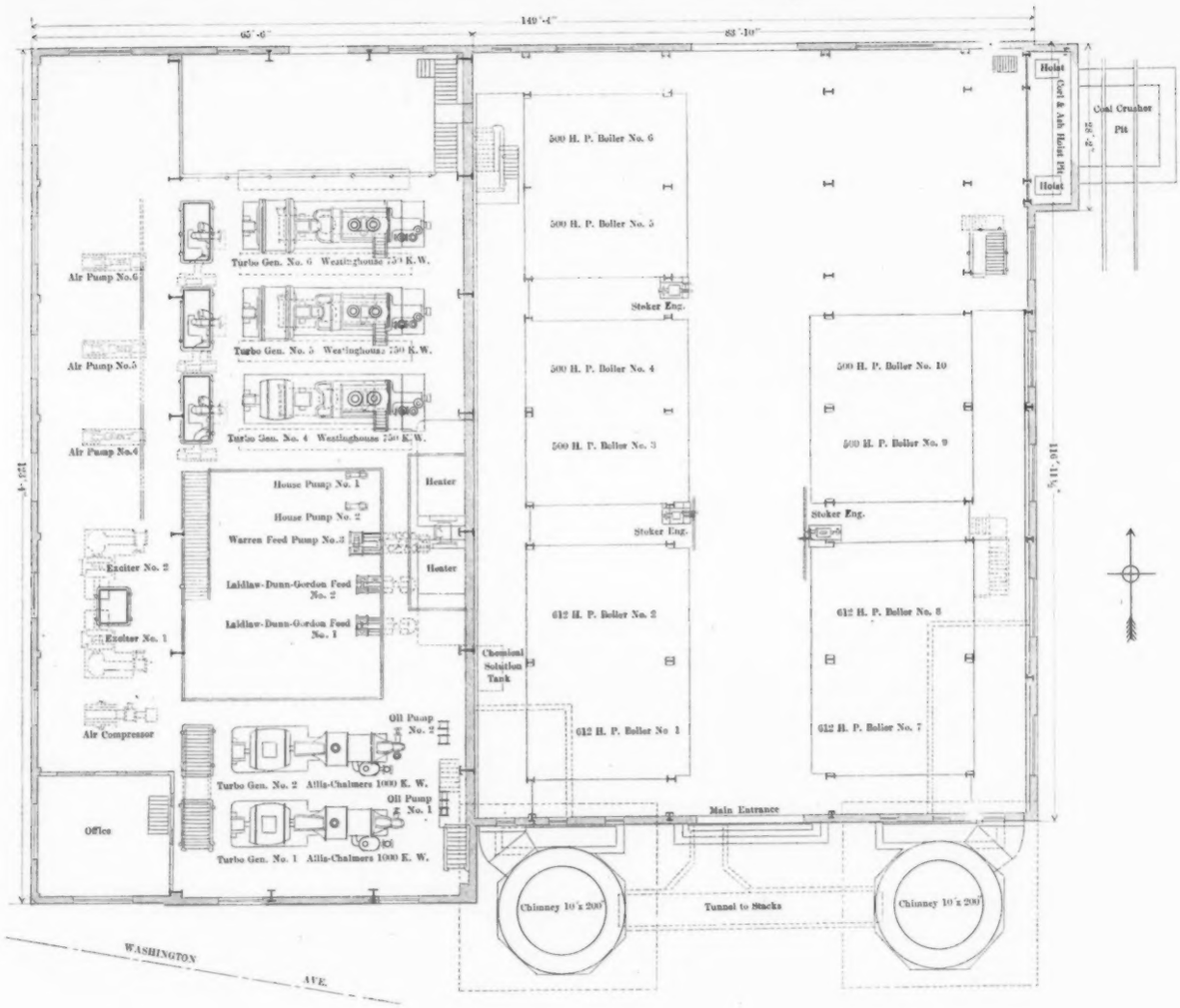


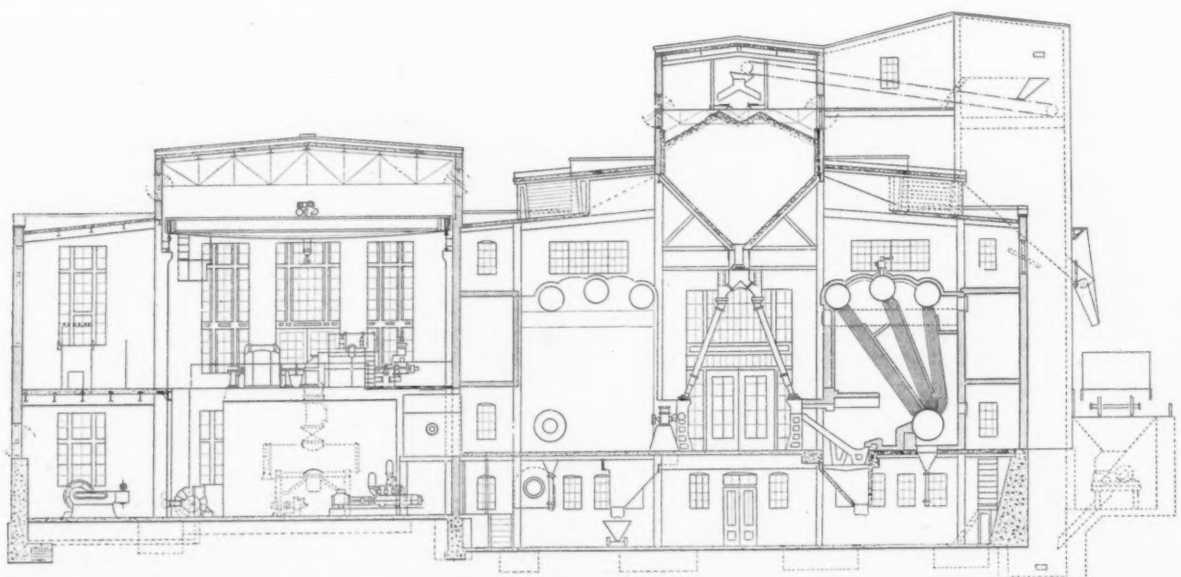
POWER PLANT OF THE MERCHANTS' HEAT AND LIGHT COMPANY, INDIANAPOLIS, IND.

As has already been stated, the growth has been so rapid it was necessary not only to add additional apparatus to the original plant, but to extend the original building to provide room for additional apparatus. The percentage of yearly growth of the company has not only been maintained, but has been increasing each year, so that in 1908 the directorate of this company decided that it was absolutely necessary to have further capacity in order to meet the demand for their product.

With this in mind the firm of J. G. White and Company, engineers and contractors, 43 Exchange Place, New York, was employed by the company to select a site for a new power house, and to carry out the engineering and construction for the new power plant, as well as for the extension of the heating and electrical distribution systems. In selecting this new site it was necessary to select one where water for condensation purposes would be available, and further where it would be more convenient to railroad facilities in order that the large amount of coal required might easily be furnished directly to the power-house site by the largest sized coal cars.

Of course, the natural location for a condensing steam station is on the bank of a river, but in this case the local conditions showed that the plant could





PLAN AND SECTIONAL ELEVATION OF THE POWER HOUSE, MERCHANTS' HEAT AND LIGHT COMPANY, INDIANAPOLIS, IND.

not be located on the White River without incurring a cost out of all proportion to the economy to be obtained from condensing operation. It was, therefore, decided to locate the new station on the property bounded by Washington Avenue, Guisendorf Street, Market Street, and the property of the Acme Milling Company, the last-named property being at the time occupied by the Chandler and Taylor Engine Works. This location provides ample water for condensing from the canal of the Indianapolis Water Company, and further affords direct connection with the railroads by means of a side track which the coal may be brought directly to the power house. This property has the further advantage of permitting extension of the new power house by an amount practically equivalent to the capacity of the new station.

The new location also allows a separate heating main to be run to the northern section of the city, so that any growth in this direction may be taken care of independent of the growth in the business section of the city.

The Merchants Company uses the low-pressure system of heating, the maximum pressure carried under the most extreme winter conditions being less than ten pounds. As the company also furnishes electricity to its customers, it was necessary to design electric generating apparatus for the maximum pressure required in the heating mains, which pressure represents the amount of back-pressure carried on the prime movers. Various technical reasons determinated that the low-pressure turbine was the best apparatus for this character of work, and therefore machines of this type were purchased and installed.

As it is the intention of abandoning the present station as far as electric generation is concerned, when the new one is completed, some of the apparatus from the old station will be moved to the new one. The apparatus to be moved includes three turbo-generators, and several hundred horsepower of Stirling boilers, with boiler feed pumps, etc. All of the machines to be moved from the old station to the new will be carefully overhauled before being reinstalled in the new station, the boilers being retubed and the turbines sent back to the factory for reblading and readjusting. The turbines when moved to the new station will operate condensing. In addition to these turbines the two others have been purchased which will operate non-condensing and against the back pressure of the steam heating system.

In designing the new station, particular care was taken to make the coal handling entirely mechanical. Two standard-gauge railway tracks have been built parallel to the boiler room and so arranged that at least five loaded cars can be admitted to this switch at the same time. An electric friction windlass has been provided at the end of the tracks so that as the cars are emptied they may be moved away and full cars placed over the coal hopper.

By reference to the plans shown herewith, it will be noted that coal is delivered to the power house in standard coal cars, dumped by gravity into a receiving coal hopper, which, in turn, admits the coal to an electrically driven coal crusher, or by-passes slack coal, which does not need to be crushed, around the crusher on to a belt conveyor which delivers the coal into a bucket conveyor. This bucket conveyor hoists the coal to the top of the power house, from which point it is transmitted by means of belt conveyors to the coal pocket. The belt conveyor over the coal bunker is provided with trippers which dump the coal in any part of the bunkers selected by the operating force. Coal is conveyed from the bunkers to the stokers through cast iron chutes provided with a cylindrical valve which regulates the supply of coal to the stoker hoppers.

In order to provide for contingencies in coal delivery, an outside coal storage of about 5,000 tons capacity has been provided. An electric locomotive crane stores the coal from incoming cars in the storage, and as this stored coal is required for operation the electric crane reclaims it and feeds it into the track hopper over the crusher, and the reclaimed coal is thus fed to the bunkers in the same manner as the incoming coal dumped from the coal cars.

The ashes are dumped from the stokers directly into an ash hopper, which hopper is provided with cast iron gates. From the ash hoppers the ashes are dumped into ash cars operating on an industrial track placed in the basement floor. These cars convey the ashes to a hopper over the bucket conveyor, which in turn hoists the ashes into an ash bunker located in the outside wall of the boiler room and at a point sufficiently high to allow the bottom discharge from this ash bunker to deliver ashes by gravity either into wagons or cars for distribution. It is thus seen that the entire operation of taking coal to the boilers and taking the ashes to distributing wagons or cars is done mechanically, excepting only the movement of the ash cars from under the ash pockets to the bucket conveyor.

Draft for the boilers has been furnished by two ten-feet-six-inches by 200-feet radial brick stacks which are sufficiently large in diameter to provide ample capacity for the boilers and which are high enough to insure adequate draft at all times. A rather unique feature about the stack arrangement is the underground tunnel for the removal of soot. For this purpose soot cars have been provided into which the soot is shoveled from the stacks and carried down an inclined runway from the tunnel into the boiler room basement, from which point the soot is carried to the bucket conveyor and thence to the ash bunker.

The boiler room has been designed so as to give ample light and ventilation under all conditions of weather. In addition to the usual windows, skylights have been provided in the boiler room roof, and louvres have also been provided for ventilation. Structural steel stairways and ladders lead to the tops of the boilers, to the main piping system, and to the coal and ash bunkers, which permit of easy access to all of the coal conveying apparatus.

The general arrangement of the turbine room is shown on the accompanying plans. The two turbines at the southern end of the building are the high-pressure turbines which operate on the heating system. The three turbines at the northern end of the building are condensing turbines. The method of operation is to use the heating turbines during the winter season, thereby supplying electric load at the same time that the greatest demand is made for heating. The condensing turbines will run only in the summer at their greatest economy when no steam for heating is required. Excitation for the turbines is furnished by two engine-driven exciters.

The condensers for the condensing turbines are of the surface type, each machine having a rotative dry-vacuum pump, an engine-driven centrifugal pump for circulating water, and a turbine-driven hot-well pump to return the

water of condensation to the feed water heaters.

Water for condensation purposes is delivered by gravity from the Indianapolis Water Company's canal to the centrifugal circulating pumps, and after this water has passed through the condensers it is returned by pressure into the canal. Such an arrangement was necessary because the water company uses the water in the canal to operate hydraulic turbines at one of the pumping stations.

The intake and discharge arrangement at the canal for the condensing conduits is such that the incoming supply for the condensers is the more distant from the flume supplying the water to the hydraulic turbines of the water company, and the discharge from the condenser conduits is located so that the warm water will discharge directly into this flume. This always assures a positive circulation of water in the canal and prevents the warm water from being taken back into the intake pipe for the condensers.

On account of the character of the water used in the boilers, it has been necessary to have the feed-water heaters act as a water-purifying device as well to heat from the boiler feed water, and all of the feed water not furnished from the water of condensation in the turbines is automatically treated by chemical compound before it is delivered to the heaters. Exhaust steam from all of the auxiliaries in the station is carried to the feed water heaters and raises the temperature of the water to about 206 degrees, at which temperature, and with the chemical compound supplied, the water is purified sufficiently for boiler purposes.

In order to clean the heaters a special arrangement has been used whereby the heaters, although located in the turbine room, may be thoroughly washed and cleansed from the boiler-room side, a copper and lead flashing having been placed around the heaters so that the water for cleansing cannot under any conditions enter the turbine room. A sump has been provided in the boiler-room operating floor immediately in front of the heaters extending the width of the heaters; and as the heaters are cleansed the deposits in them are washed into this sump and flushed into the sewer through two large drain pipes which lead from the sump.

The capacity of the power house as designed at the present time will be 5,448 horsepower of boilers at rating, and 4,500 kilowatts of turbines at rating. There is, however, space in the boiler room for 1,000 additional horsepower of boilers, and in the turbine room space for two more turbines, one of which can be of 1,000 kilowatts capacity, and the other one of 3,000 kilowatts capacity, as determined by the growth of the load.

The building is so designed that no alteration in it will be necessary, as all foundations for these machines have been placed during the present construction period.

An electric traveling crane of the three-motor type has been provided in the turbine room for dismantling and erecting machinery.

The foundations of the building are of mass concrete. The steelwork for the building is self-supporting. The brick walls are laid up with cement mortar; all of the floors and roofs are of concrete, and all doors between the boiler and turbine rooms are of standard fireproof construction. It is therefore, seen that the building is as near fireproof as it is possible to make it, the only wood about the construction being the door and window frames in the outside walls.

Electricity is generated at this station under a pressure of 2,300 volts, and from this point is carried through high-tension conduits to two substations for direct-current distribution. The switchboard is of the most improved type, having remote control switches which operate the high-tension oil switches. These oil switches are located on the switchboard operating gallery and therefore none of this wiring is concealed and is always easy of access for investigation. The busbars are carried on standard pipe supports about eight feet above the floor and five feet above the oil switches. All of the buses and switches are in view of the operator and it is never necessary for the operator to leave the switchboard gallery under operating conditions.

The distributing system between the power house and the substations is laid in tile conduit underground, and this conduit in turn is incased in a cover of concrete. Manholes are provided at frequent intervals to allow for examination.

Two substations are provided, one located at Pearl Street, east of Illinois Street, and one northeast of Monument Square in the corner between Delaware and New York Streets. In the first substation are located two 1,000-kilowatt motor-generator sets, with exciters, balancer sets, etc., and all switching apparatus necessary to furnish power for electric distribution, either for lighting or power. In the second substation there are two rotary convertors with all necessary switchboard apparatus, etc.

Steam for heating is supplied from the new power house through a thirty-inch steam main between the power house on Senate Avenue, at which point this main connects with one twenty-four inch and one twenty-inch main. These two latter mains connect to the present distributing systems of the Merchants Company. Cross sections of the heating main conduit are shown on the accompanying drawings. From these sections it will be seen that there is ample room around the heating mains in the conduits to permit of any repairs necessary without taking the pipe out of the ground, unless the pipe itself has been destroyed, access for repairs to all expansion joints, etc., being provided through the manhole conduits.

In order to permit expansion in the mains, special expansion joints with brass sleeves have been provided, and these have been placed at frequent intervals to allow for the uniform expansion due to heating, and for the unequal expansion due to turning steam into cold mains, as it is evident that if the mains are cold and steam is turned on, the tops of the pipes will become heated and expand before the bottom of the mains.

All of the pipe used in this work is rivited steel plate of heavy design with steel flanges. The expansion joints are of cast iron, except in the slip sleeves, which are of brass carefully machined. Each expansion joint is placed in a manhole and is provided with a low-pressure trap. The pipe itself is supported in the conduit on a pipe roll carried on a cast iron support. All piping is carefully insulated with alternate layers of asbestos and mineral wool.

At frequent intervals vertical nozzles have been provided for service connections, such of these as are not used at present, being cut off by means of blank flanges. Corrugated copper gaskets are used for making joints. All right-angled bends have been replaced with two forty-five-degree bends in order to eliminate friction as far as possible.

The new power-house equipment is as follows:

The boilers of 500-horsepower capacity are of the Stirling type. These are so designed that they conform in overall dimensions to the 612-horsepower Stirling boilers which will be moved to the new plant from the present station. The boilers are equipped with the improved type of Rooney stoker, having large grate areas to insure complete combustion, and to give large overload capacity to the boilers. The stokers are driven by standard Westinghouse stoker engines.

The non-condensing turbines are of the Allis-Chalmers type, and the condensing turbines are of the Westinghouse type.

The condensers were furnished by the International Steam Pump Company, and, with the exception of the circulating-pump engine, were manufactured by this concern. The pump engine was built by the Harrisburg Foundry and Machine Company.

The exciter generators are furnished by the Allis-Chalmers Company, and the engines by the Chandler & Taylor Engine Works.

The coal-handling apparatus was installed by the Link Bolt Company, excepting only the coal crusher, which was furnished by the Mead-Morrison Company.

The electric crane was furnished by Pawling & Harnischfeger.

The boiler feed pumps and house pumps were furnished by the Warren Steam Pump Company, and the feedwater heaters, of the Cochrane type, were furnished by the Harrison Safety Boiler Works.

House Heating from Central Stations.

The U. S. Geological Survey has made tests to show the fuel value of different kinds of coal and of briquets when used in house-heating boilers, and the results are reported in Survey Bulletin 366, by D. T. Randall. The tables and diagrams showing the relative value of different fuels for domestic use indicate that coals containing the highest percentage of fixed carbon give the least smoke and are also the most efficient heat producers.

In connection with the investigation a general inquiry was made as to the economy of house-heating plants that supply heat from a central station to a group of buildings. Replies to inquiries sent to fifty-seven such plants indicate that they are economical for the householder and that their more general establishment and use will greatly reduce the amount of smoke generated in cities. Mr. Randall expresses the opinion that if all the factors concerned in the production of heat on the premises are considered, such as cost of plant, depreciation, repairs, cost of fuel and labor, and the elimination of all discomfort from dust, ashes, or smoke, the householder is fortunate who can purchase heat from a central station at a reasonable price.

Bulletin 366 may be obtained free by applying to the Director, United States Geological Survey, Washington, D. C.

A Novel Application of Water Power.

In a recent issue of *Power and the Engineer*, from which the following description and illustration are taken, Edward T. Binns describes a novel application of waterpower economy in New England, where three power plants are operated by a textile-manufacturing company for running three mills, situated about one and a half miles apart. The three stations furnish electricity for these mills by means of three water turbines, direct-connected with so-called water-wheel alternators.

During a considerable part of the year there is not sufficient water to run the mills from one of the stations for an entire day. At the time of the author's visit the water was exceedingly low, and all the water running in the creek was caught in the upper dam during the night. The upper station was started in the morning, carrying the three motor-driven mills until the water was nearly gone. The operator then telephoned to the center-station operator to put his machine on the line. When started up and the voltage equalized, No. 1 plant was cut out and shut down. The same procedure was carried out with No. 3 plant when the water for No. 2 plant got low.

The water was carried to the turbines by penstocks, one of which was seven feet in diameter, having a fall of sixty feet. Shaft-driven governors regulated the amount of water admitted, so as to maintain a uniform speed.

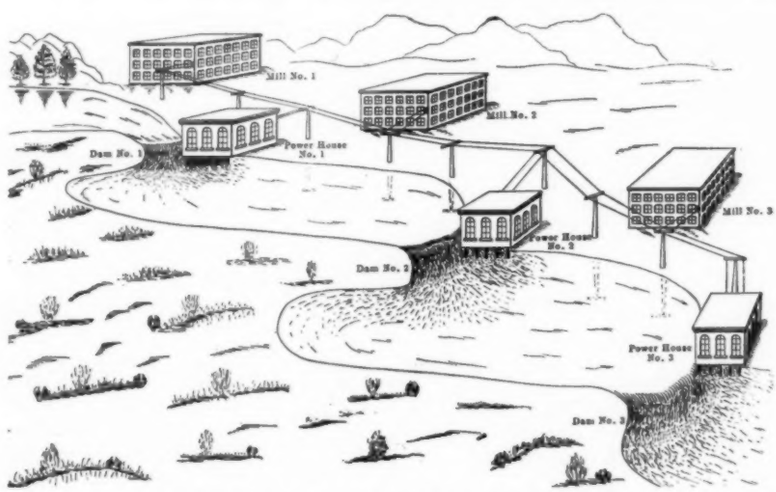


DIAGRAM SHOWING ARRANGEMENT OF POWER HOUSES.

World's Rubber Production.

A recent number of the Daily Consular and Trade Reports contains a quite extensive review of the rubber production of the world. In this publication the climatic condition of the several rubber producing countries are taken separately and the amount and value of the exports are given.

The Amazon Valley of Brazil, which leads the world, exported in one year 81,883,934 pounds of rubber which had a total value of $55,305,984.

National Electric Light Association Membership.

The rapid growth in the membership of the National Electric Light Association continues at a steady pace all over the country. On February 14 the total membership was 4,562, subdivided as follows: Class A, 783; Class B, 3,182; Class C, 5; Class D, 193; Class E, 405. These figures indicate a gross gain of 1,332 in the membership since July 1, 1909. This is believed to be a larger proportionate and net gain than has been made before in any engineering body in a corresponding period of time.

A Modern Concrete Chimney for An Electric-Light Plant.

Within the last few years the practicability and high efficiency of reinforced concrete chimneys have been amply established. Many chimneys have been built of various designs and differing in their mode of erection. Most have been successful, a few have been failures, the failures being traceable in every case to faulty workmanship or poor design.

The earlier concrete chimneys were of the cylindrical or offset type. There are, however, decided objections to this offset type, and these objections have been overcome in the tapering concrete chimney, which represents the latest and best type of chimney design. A chimney of this type, which should be of special interest to central-station men, has recently been completed at the plant of the Muncie Electric Light Company, at Muncie, Ind., by the General Concrete Construction Company, of Chicago.

The American Gas and Electric Company, which controls the Muncie Electric Light Company, considered the erection of a self-supporting, brick-lined, steel chimney, and a Tapering Concrete Chimney. Acting in conjunction with the engineers, Sargent & Lundy, of Chicago, the company decided to adopt the latter type.

In the construction of this chimney a special form, designed and patented by Carl Stieler, of the General Concrete Construction Company, was used. By means of this form the inside and outside surfaces of the chimney were kept perfectly circular and concentric, and the batter or taper was evenly distributed about the center line.

The steel forms are five feet high. They are composed of steel plates attached to rings by means of long radial bolts. The rings are made of heavy angles bent and spliced into circles of sufficient diameter to surround the base of the chimney. The diameter of the rings remains constant. The variation in the diameter of the forms to fit the taper and the decreasing wall thickness, is effected by means of the radial bolts.

The chimney at Muncie is 250 feet six inches high, and has an inside diameter of fourteen feet six inches. The thickness of the shell at the top is eight inches, which increases uniformly to twenty and five-eighths inches at the base. The vertical reinforcement consists of five-eighth-inch square, twisted bars, spaced about twenty-four-inch centers. These bars are carried down and bent under the horizontal steel reinforcement in the foundation, thus affording additional anchorage. The horizontal reinforcement of the chimney consists of wire mesh, composed of quarter-inch round rods spaced four-inch centers and laced triangularly with lighter wire. This is wrapped around the outside of the vertical steel and wired to it. The mesh is placed two and one-half inches from the surface of the chimney, thus preventing surface cracks. Sufficient additional steel and concrete was placed about the flue openings to offset the loss in material due to these openings.

The foundation is in the form of a truncated pyramid three feet high resting upon a rectangular slab thirty-eight by forty-two by two and one-half feet in size. It is the usual practice to make the foundation square, but in this case the oblong shape is necessary, because a wall separating the engine and boiler rooms rested on one side of the foundation.

THE CONCRETE CHIMNEY OF THE PLANT OF THE MUNCIE (IND.) ELECTRIC LIGHT COMPANY.

The foundation reinforcement consists of two series of three-fourth-inch square twisted bars. The bars in the upper series are spaced about twenty-four-inch centers and are laid parallel with the side of the foundation about two inches from top of the rectangular slab. The bars in the lower series are spaced about twelve-inch centers and laid at an angle of forty-five degrees to the sides of the foundation and about three inches from the bottom of the slab.

The concrete in the chimney proper is composed of one part Portland cement, two and one-half parts of clean sand and three parts of clean gravel. A very wet mixture was used so that when the forms were filled, water would float to the top. The concrete was thoroughly tamped about the steel, thus insuring a perfect bond and the elimination of voids.

The concrete in the foundation was composed of one part Portland cement, three parts clean sand and six parts crushed limestone. The limestone was permissible since the foundation is not subjected to any heat, which might possibly have a bad effect upon the stone.

The foundation rests upon a bed of hard gravel capable of bearing many times the load imposed. The foundation is about twenty feet below grade and directly under the basement of the boiler room.

The chimney is lined throughout its entire height. The lining is composed of firebrick backed with two courses of hard common brick for eighty-four feet. One course of common brick was used for the next eighty-four feet and the balance of the height was lined with one course of firebrick. Since the lining is vertical and the chimney shell tapering, an air space is afforded between the lining and the concrete varying from twenty-four to three inches. There are two flue openings on opposite sides of the chimney. To prevent the passage of gases from one flue into the opposite opening, a baffle wall was placed in the chimney at an angle of forty-five degrees.

This chimney is of special interest by reason of its unusual design. The engineers specified that it should be designed to withstand a wind velocity of not less than 100 miles per hour and that it should have sufficient weight to overcome the wind moment resulting from such velocity and develop no tension in the concrete or the steel reinforcement on the windward side. In the construction of reinforced concrete chimneys it is the usual practice to stress the vertical steel reinforcement to about 16,000 pounds per square inch, the steel taking all of the tension, the concrete being counted on for compression only. In this case, however, the chimney walls were made sufficiently heavy so that no reinforcement was necessary except for temperature and shrinkage cracks.

TELEPHONY—TELEGRAPHY, and WIRELESS.

THE EARLY DAYS OF THE TELEPHONE.

INTERESTING HISTORICAL FACTS RESPECTING THIS GREAT INVENTION AS TOLD BY THE FIRST GENERAL MANAGER OF THE BELL TELEPHONE COMPANY.

Recently a joint committee of the Legislature of New York State was appointed pursuant to a resolution of the Senate and Assembly to investigate the question of extending the jurisdiction and powers of the Public Service Commission of that state to and over telephone and telegraph companies. This committee held several sessions in New York city, and among those who testified before it was Theodore N. Vail, now president of the American Telephone and Telegraph Company, and the first general manager of the Bell Telephone Company, at the beginning of the telephone industry.

In response to an inquiry from the counsel representing the committee, Mr. Vail stated his present position and that he became interested in the telephone in 1878 at its very beginning. Mr. Vail had retired from active work in the telephone field in 1887; then became a director in 1900 again, and in 1907 became president of the American Telephone and Telegraph Company.

The testimony which follows was taken in shorthand at the time it was given, and is so full of interest that the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN presents it quite fully:

Q. Mr. Vail, when was the American Telephone and Telegraph Company organized?

A. The company was organized in 1884 for the purpose of building long-distance lines connecting the systems of the country with each other; but it took over the business of the old Bell company in 1899, I think it was.

Q. What business were you engaged in prior to 1878, when you became interested in the telephone business?

A. I was in the Railway Mail Service in Washington, resigning as general superintendent in 1878.

Q. And in 1878 you went with what company?

A. When I first became interested there was merely an association composed of Gardiner Hubbard, Messrs. Saunders, Bell and Watson. Then was organized the New England Company, not the present New England Telephone Company, but a company owning the Bell patents. In the spring of 1878 the Bell Telephone Company was organized.

Q. Now, Mr. Vail, will you start in at the beginning of your connection with the telephone business in 1878 and give to the committee its history in a general way, and tell the committee just how that business has been built up and how the various parts of it have been brought together?

A. Of course you know that the first public demonstration of the telephone was at the Centennial Exposition of 1876. The first commercial telephone was made along in 1877. I became interested from the fact that contention in regard to the compensation of railroads for the transportation of mails was as lively then as it is now, and Congress had appointed a committee to investigate the matter, with Gardiner G. Hubbard at the head. Mr. Hubbard was the man who financed Bell in his telephone work, and was his father-in-law. Mr. Hubbard used to talk with me about the telephone, and when they had really produced a commercial instrument, they approached me with a view to my becoming interested. At that time, as I say, it was an association, a joint stock association, with a capital of $300,000, I think, divided among the four gentlemen I have named. In the spring of 1878 was formed the Bell Telephone Company, owning all the patents. Thus there were two companies—the New England Company, with a capital of $200,000, and the Bell Company, with a capital of $450,000. These companies were put together and a new company was formed with a capital of $850,000, of which $200,000 was stock which was sold, and $450,000 given to the shareholders of the old company, share for share. The $200,000 worth of stock was sold for $430,000, realizing that much in cash, and with that cash the business was developed. We realized early in the day that a big general system could be established, with agencies in small areas. We could not get capital. It was hard work. So we had to get young men who were interested in the business with small capital, and let them take their energy and their ambition and their prospective profit to take the place of large capital, and in that way we built up in small territories the business quite generally. There was so much happened just at that time that one can't remember all of it. You see, the possibilities of the telephone were not realized. The first use of it was on private lines connecting with your stable, or your business house and your factory, or your house in the country.

Previous to this time the Gold and Stock Company, which was a subsidiary of the Western Union Telegraph Company, was doing a private line business equipped with printing instruments that were used to communicate from one place to another the same as the telephone is now used; and the substitution of the telephone for these printing instruments is what led to the controversy between the Bell and Western Union. Customers began equipping their lines with the telephone instead of the printing telegraph, so in the fall of 1878 the Gold and Stock Company entered the telephone business under the auspices of the Western Union Telegraph Company, and in opposition to the Bell Company.

Then Edison invented his carbon transmitter in 1878—in July I think it was, so that from July until December, 1878, we were considerably at a disadvantage, although we did hold our own until we got out what is known as the Blake transmitter. Then, of course, we had a transmitter that enabled us to maintain our position. In the meantime we were licensing in all territories for exchange purposes. These licenses had all the business of the telephone in their localities, but under the agreement we retained for ourselves the right to connect them with each other—to make a national system of them. The business went on in active competition with the Western Union until the fall of 1879, when for one reason or another, overtures were made and the arrangement between the Western Union company and our company was made by which the former turned over all patents to us, and we licensed them for private line and telephone purposes under our patents. We retained what you call the telephone exchange, and the toll line business, and they retained the right to do private line business, although it was not exclusive. Nearly all our licenses were short-time licenses. A few of these smaller territories were combined into a larger territory, and they have gradually formed into what are known as the Associated Companies; that is, they are companies subsidiary to the American Telephone and Telegraph Company, operating in certain defined territory, like the Buffalo or the Empire State or the Hudson River or New York & New Jersey companies. The lines upon which these combinations were made were very seldom commercial lines; they were haphazard.

I think it was in 1880 the first line was built which might be called a long-distance line. Previous to that time the talking had been purely within exchange limits. In 1880 we developed the possibility of talking over considerable distances, and the first line was built between Boston and Lowell, which was then called a long-distance line, but wouldn't be called that now. Then we built a line between New York and Boston, stringing the lines on the poles of the Associated Companies; so that was the first real long-distance line. It was successful, and in 1884, I think, or about then, the American Telephone and Telegraph Company was formed to take over that long-distance line, and the Bell Company granted the American Telephone and Telegraph Company exclusive rights to connect these different associated companies and different exchanges with each other.

Thus the American Telephone and Telegraph Company was formed for long-distance business.

In the meantime the Bell Company had outgrown its capital of $850,000, and had spent the $430,000 that it had received from the sale of stock, and more, too, and was in debt, and so we formed the American Bell Telephone Company. The American Bell Telephone Company began with a capital of about $6,000,000, six shares for one being given to the old Bell Company. The American Bell then carried on the business of the old Bell Company, and the old associa-

tion. They owned the patents, issued the licenses and conducted the business in a general way all over the country. The American Bell company lasted until 1899, when the business was sold out to the American Telephone and Telegraph Company, which was at that time doing a long-distance business.

In the very early days the American Bell, recognizing the possibilities of the business and the ultimate value, in addition to whatever rental or royalty it got upon the telephones, retained also a partnership in the business, and in that way, when permanent contracts were granted, it became a stockholder of those local companies, the stock being given for the exclusive rights and everything of that kind. In that way the American Telephone and Telegraph Company became either a majority or very large owner in all of these subsidiary companies all over the country, and that is a large part of the profit of the company today, namely, its holdings in the subsidiary companies and the purchase of these interests as they increased from time to time. This is the cause of our financing. We do our financing either for the purpose of building long-distance lines or buying our proportion of the increased capital stock of these subsidiary companies—increased for the purpose of extending the business.

That is a general outline of the business up to 1899. The growth was comparatively slow, because the public had to be educated. As soon as the public was educated to the necessity and advantages of the telephone, the growth became very fast indeed, and during the last ten years it has extended by leaps and bounds. Today no man thinks of going into business or having a residence unless he has telephone connection; but it took a long time to educate the people to that point. One thing that brought about that education was the fact that the Bell company was always more or less in advance of the actual requirements of the public, so that facilities were ready for the public before they really knew that they wanted them. That is the way with our long-distance business. We have tried to keep in advance of the actual requirements of the public.

Q. What part has the development and perfection of the devices used had to do with the rapid growth of the business?

A. A great deal. For instance, the telephone receiver is practically the same today as when it first came out of the shop, but the transmitter that was originally used for transmittal was rather weak and could not carry the voice any great distance. It was with difficulty that we talked with the Blake transmitter from Boston to New York. Then was developed the present carbon transmitters that are in general use today. We have a large body of engineers, both in our own laboratory and also in the Western Electric Company, at work meeting the new developments or new suggestions that come up in the business, and studying the business all the time and seeing what can be done to meet it. For instance, you consider the conditions that exist today in regard to high-tension service, electric light, electric street railways and the electrification of railroads. If these conditions had existed when the telephone first started I do not believe the long-distance line business would have ever been developed. There are places that without these modern devices—the arrangement of the wires and the little things we attach to them, the Pupin coils and things of that kind—you could not talk at all. The telephone current would have been drowned out by the electric light or other heavy currents. You occasionally hear that great buzzing now. All of that had to be overcome, and that has been the study of our engineers and our mechanical experts; so that the development of the art has been a little in advance of the development of the business. That development in the art, of course, I know in a general way, but our engineers—if you want to get it—could probably give you very interesting——

Q. Won't you give the name of your engineer, Mr. Vail, who would be best posted in regard to that?

A. J. J. Carty.

Q. Located here in New York?

A. Yes, he has been connected with the telephone business ever since it began. He started in the first exchange that was established in Boston.

Q. Do you look for any further advance in the art of telephoning?

A. There has not been a day hardly that there is not some progress made. It is not by leaps and bounds; it is gradual. The engineer of the eighties would not recognize the business if he should come back and look at it today. There are new difficulties coming up, and of course they have to be overcome. We have a staff—I suppose 250 men—studying these problems all the time. Then, too, as the traffic increases and becomes congested it requires that a different method of handling it be developed. Our experts are continually at work. For instance, today, as far as the public is concerned, you can have a commercial talk with Chicago, but not always. It is very good between New York and Boston, and New York and Philadelphia, and I think this coming year you will have just as good service between New York and Chicago as between New York and Boston, and New York and Philadelphia.

There is another thing: that is the tendency to try to get our wires under ground. There are a great many difficulties to overcome there. We have an underground service between New York and Philadelphia, and it is a good commercial working cable line. We are now gradually extending these underground lines to Boston, feeling our way along and overcoming difficulties as they arrive. The fact that we connect your overhead wires to the underground in Boston and New York makes an appreciable difference in the talk. But you had better get that from the engineer. These are difficulties we are continually trying to overcome, and I think it is certain that within a few years we shall be able to talk to San Francisco. About half of our wires between New York and Philadelphia are now under ground.

Q. In the beginning of the long-distance service did you use the same system in regard to circuits as is used now?

A. The thing that made long-distance service possible was the evolution of what we call the metallic circuit; that is, it is really a twisted wire, but as you run it along the poles you transpose it so that the influences balance each other; in other words, the bad influence on one wire overcomes the bad influence on another wire. Then another thing called retardation is overcome by the Pupin coil, and these are being introduced gradually. When the coil was first invented we could not use it under certain conditions, and we had to find out what these conditions were and overcome them.

Q. Is the Pupin coil attached to the end of the long-distance line?

A. No, it is attached at intervals along the line.

Q. The object of it is to overcome induction and other difficulties?

A. I do not know whether the engineers call it induction or not, but it is a back fire of some kind that makes it difficult to talk.

Q. What time was the copper circuit first introduced in the local exchanges?

A. The idea was a very early one. It was developed because iron wire, as you no doubt remember, in the early days of the telephone, was run all over house-tops, and the creosote and smoke used to eat them up so that the wire did not last over a year or so; and then at some places along the seashore the wires were destroyed very rapidly. We thought that copper wire could be introduced and be advantageous in many ways. First, it is indestructible; there is almost no depreciation; next, you can use a much lighter wire than iron on account of the much larger conductivity. The third was that the back kick, or whatever you call it, was less in copper wire than in iron. But the trouble at the beginning was that the wire was too soft, but it was considered that if we could get a copper wire that would stand the strain, it would pay us to use it. So we detailed an engineer and put him on that, and he, in connection with the copper manufacturers, finally produced a copper wire that would stand the strain from pole to pole. That was about 1883—just in time to stretch between New York and Boston. Of course, in the cables copper wire could always be used, because there is no strain on it; but at that time you could not talk through a cable; and it was along about this same time that we had five miles of cable with different sized wires and laid it along the Providence Railroad, and had Professor Cross, of Harvard University, and Professor Jacques, and some of our own engineers, engage in the work. And they did actually work it out, and from their studies underground cables were made possible. Then we began to put our wires underground in the cities as fast as we could do it under our franchises and as rapidly as it was practicable, so that I think now of our exchange wires, seventy-five or eighty per cent are under ground. Of course, the price of copper and other things has had a great deal to do with the development. If copper was away up, then of course we had to use iron, but if copper was cheap, we used that generally. In the underground business all is copper.

Q. Were the telephones throughout the country at that time connected with the local exchanges with iron wire?

A. Yes, for a long time.

Q. First you used iron and then copper?

A. No, I do not think the single wire was ever copper; that was always iron. The first exchanges were built with grounded circuits, but just when they were changed from grounded to metallic circuits I do not remember. The change was made after I went out of the business, and before I came back; but it was found that electric street railway wires or electric light wires made so much trouble on a single wire that the metallic circuit was introduced. Today there is practically no such thing as a grounded circuit in any exchange of any importance in the country.

Q. Do you have any contract with your engineers whereby you have the right to their inventions?

A. We have wherever these inventions grow out of the fact that they are studying for us the problems to be met. We have the absolute ownership.

Q. There is a belief that the telephone company has purchased many valuable inventions from time to time, which if put in use would greatly improve the telephone service, and that the company, after purchasing the patent, cast it aside rather than go to the expense of making the improvement. Would you care to say anything about that, as to whether or not it is true?

A. I know that is the popular belief, but I also know perfectly well that it is not true. Of course, it is very natural for an inventor to think that he has something that is very important, and very frequently such inventions are submitted to us. We have to be exceedingly careful, because in nine cases out of ten it is an old device rediscovered by some one who is not possessed of a thorough knowledge of the business. I can say this, that I do not think there is a single device in telephony that would be an improvement on the present methods that would not be adopted if it could be shown to be an improvement; but you must remember that what will work in the laboratory is an entirely different thing under outside conditions, where there are other electric currents and all sorts of disturbances.

Q. So that belief, which is more or less popular, is founded on a myth?

A. It is a delusion. When you come to realize, it is a wonder that the telephone, under the conditions, would work at all. The current that is used is so small that it can not be measured by anything except the telephone. It is about 0.000003 of the current that lights your incandescent lamp. I asked an engineer one day and he said the current of the telephone, if passed through one teaspoonful of water, would take, well, I do not know how many weeks to heat it one degree.

Q. In what foreign countries was the telephone patented?

A. In England and I think pretty generally over the Continent and in Canada and South America.

Q. Do you understand that the discovery of the telephone was made by Mr. Bell by reason of his wife being deaf?

A. The discovery of the telephone is very interesting.

Q. Won't you tell that story, Mr. Vail?

A. Mr. Bell was in poor health in Scotland and came to this country and settled in Canada. At that time there was a great idea of producing something that would multiply the facilities of telegraph wires, and the idea was mainly on the harmonic principle. For instance, you take five or six tuning forks and you can transmit those notes separately over the same wire—a large number. And there was a great many workers on what we call the harmonic telegraph —Gray and others. Bell became interested and devoted himself to the matter. Prior to that he had been a professor of acoustics, and his father had discovered what they called visible speech—that is, putting your mouth in certain positions to utter certain sounds, and teaching people to watch the lips and talk in that way. Mrs. Bell, for instance, could not hear Mr. Bell speak. She talked so that one would think she had a little trouble with her throat. Professor Bell's father discovered visible speech and Professor Bell taught it. The idea was brought to this country in connection with Harvard University. In the course of Bell's experiments with this harmonic telephone or transmission of these vibrations over the wire, it occurred to him that if you could transmit tones, you could also transmit vocal sounds. The difference between the vibration of the tone or a note and that of vocal sounds is that one is regular in its pitch and the other irregular. Bell was probably the only one of the investigators at that time who understood what the requirements were. His first idea of producing these irregular vibrations in the air was by a combination of different notes, following out a principle discovered by the foremost scientists. So he built what he called a harp transmitter. His idea was to strike two or three notes, and strike two or three others, and make other vowel sounds, and in that way transmit vocal speech. He knew the principle from striking one of these springs before the magnet in the transmitter—or at least, he was listening to the transmitter, and he heard a sound which was peculiar. In other words, it gave what you might call the color of the voice or the color of the sound as distinguished from a musical sound. He immediately ran into the room and asked Watson, who was experimenting with him, and Watson said he pulled a string and vibrated it in front of him, and then did it again. And they continued until Bell found that without the use of the vibrator, and with the use of these magnetic transmitters, he could transfer what was actually a vocal sound. His next step was to take a string and put a diaphragm in and an ear to it, and talk to it and have the corresponding transmitter at the end. It worked to a certain extent, but imperfectly. But the evolution from that to the iron diaphragm was very rapid indeed. So these experiments in 1876—or at the close of 1875—showed, by the spring of 1876, that he had developed what really was a speaking telephone, and which was ready for exhibition at the Centennial.

There is another curious feature about it, and that is that the Centennial management would not put the instrument in a proper place, so that Gardiner G. Hubbard, who was the chairman of the Massachusetts Commission to the Centennial, put it in the Massachusetts exhibits of various kinds, and it was labeled "transmitting telegraph." The commission appointed to examine the exhibits did not get around to the telephone until very late at night, and were going to give it scant attention, but the Emperor of Brazil, who was in the Commission, happened to have met Prof. Bell, and became interested in his visible speech. He rushed up to Professor Bell saying: "How do you do, Professor Bell? I am very glad to see you again." This of course drew the attention of the committee to Prof. Bell, and they were a little more willing to listen to his telephone. This got him his hearing. If it had not been for that it probably would have been another year before Bell would have received any public hearing at all.

Q. What was the very first local exchange that was built?

A. Well, that you could not get any two men to agree upon. Many cities claims that. My impression is that Boston was really the first, but at the time the telephone was developed there had already been started what were called telegraph exchanges—lines radiating from central offices exactly the same as in our exchange, but using the printing telegraph. The first telephones were used to replace these printing telegraphs, the same as used on private lines. For this reason the first exchange is very uncertain. Bridgeport claims it, Boston claims it, Jamestown, N. Y., claims it—go over the whole country, and you will find some claim for it. Things went along so fast for about a year and a half that it is very hard indeed to fix the matter. I was surprised when I came back to the telephone field. I was called to look up information on a certain point, and things that I had in mind that covered years were all performed in something like eighteen months.

Q. Can you tell about the number of companies that are licensees under the Bell patents that are owned by the American Telephone and Telegraph Company at the present time?

A. Yes, there are something like thirty to thirty-five direct licensees, and then there are some sub-licensees who receive their licenses from the licensed companies. There are many hundreds of them, but they have no direct relation with the American Telephone and Telegraph Company; only through the associated companies.

Q. And you are speaking now of only the United States?

A. Yes, the American Telephone and Telegraph Company does no business outside of the United States, with the exception that it has an ownership in Canada. That is the only case.

Q. What does experience teach you is the average life of a telephone plant?

A. That varies every year. In my last annual report I attempted to give it for each class of property. But every year the life is improving. We now have only ten per cent of iron wire in use in the country. The life of iron wire varies from a year and a half up to fifteen years or sixteen years. Poles have an average life of fifteen or sixteen years. Copper wire is almost indestructible.

Q. You are referring to cedar poles or chestnut poles?

A. The average poles.

Q. The average of the two?

A. You take the old red cedar and it will stand up for tweny-five or thirty years. Take some poles in certain grounds, and they will wear away in two or three years. We estimate that seven to eight per cent of the value of the property, under modern conditions, is more or less a fair provision for depreciation and maintenance.

Q. Now, on the question of depreciation, you speak of different kinds of construction depreciating more rapidly than other kinds. Assuming that you have two systems, both using copper circuits entirely, or using practically all-copper circuits, and one system is largely an underground system in conduits, and the other is an aerial system—wires and cables strung on poles—which system will depreciate the more rapidly?

A. The aerial system, very much more rapidly. We have not been able to determine exactly what the depreciation of underground construction is, but we have placed its life at forty years for the cables and wires only. This is for cables only. The conduits we placed also at forty or fifty years. Some of the first conduits that we ever put down are still in use.

Q. And those were put down how long ago?

A. We commenced in New York—we commenced in the other cities before—in 80 or '82 the first underground and the great bulk of our exchange system. I have forgotten the percentage now, but I could tell by looking at my report, but I think fully seventy-five per cent of our wires in the United States in use in the exchanges are under ground.

Q. The American Telephone and Telegraph Company owns an interest in a manufacturing company, doesn't it?

A. Yes, the Western Electric Company. It owns $12,000,000 out of $15,000,000 of stock in this company.

Q. Does that company have or require a license from the American Telephone and Telegraph Company in order to allow it to manufacture the devices which it does manufacture for the licensees of the American company?

A. It has to have a license under all the patents of the American Telephone and Telegraph Company, but it is a large owner of patents itself.

Q. That is, there are many patented devices which it manufactures and in which the American Telephone and Telegraph Company has no interest except such interest as it has as a stockholder of the Western Electric?

A. Yes, practically all of the devices—patented devices—are manufactured under patents held by the Western Electric.

Q. When did the American Telephone and Telegraph Company first become a shareholder in the Western Electric?

A. In 1880 there were half a dozen different manufacturers of telephonic apparatus. They were manufacturing each a different style, different standards and different appliances, and that company was buying from them. We gradually reduced the number to three or four principal ones. We found that it was very necessary, in order to standardize the business and make intercommunication certain and effective, that the apparatus should be standardized, so we consolidated all of the manufacturing companies into one company. The Western Electric was formerly a Western Union company; that is, it was not owned by the Western Union outright, but it was largely owned by those connected with the Western Union. It had some patents on telephonic appliances, and it was the biggest corporation of the kind then in existence; so we took the principal manufacturers of telephonic apparatus and formed one company called the Western Electric Company. That was done in 1880, I think.

Q. What were the companies that were put together at that time?

A. There was a company in Cincinnati—a copartnership; the Gilliland Company, of Indianapolis; Charles Williams, who was an individual manufacturer in Boston and who built the original telephone instruments and at whose place all the original experiments were made; and a man by the name of Davis, of Baltimore. Those were the principal owners that were brought together.

Q. Did you state the number of shares of the Western Union Telegraph Company which were acquired by the American Telephone and Telegraph Company?

A. No, I did not.

Q. Will you state?

A. It was approximately thirty millions—300,000 shares.

Q. Of the par value of approximately $30,000,000?

A. Yes, sir.

Q. And that is out of a total issue of Western Union of $90,000,000?

A. Practically $100,000,000.

Q. What do you say, Mr. Vail, as to whether or not you are more familiar with the financial operations of the company or the practical operations?

A. Well, that is pretty difficult to say.

Q. You have given some attention to both, have you not?

A. Yes. So far as the detail practical operations, of course there is no one man who understands them all now. In going through a large exchange the other day I asked Mr. Carty to explain something to me. He said he could not do it. This was the chief engineer. He referred me to the assistant, who said he could not, and I finally referred to the manager, who did not know. Finally we secured the information from an engineer. You can thus judge of the complications of the business. All I undertake to do is to look up matters in detail occasionally and see how things are going. But in case of any great modifcation or change I become familiar enough with it to give an opinion as to whether it is a good thing to adopt it. To undertake to keep up with all the details, however, is something that I do not care to do at my age.

Q. Well, you seem to be a comparatively young man. Now, what do you say as to the possibility or practicability of one telephone company giving intercommunication with the subscribers of another telephone company when they are equipped with different styles of apparatus?

A. It would be unsatisfactory; there is no question about that at all.

Q. Would it be possible to communicate?

A. Most anything is possible when people undertake to do it.

Q. Has it ever been done?

A. Yes, it is being done every day.

Q. That is, there are some so-called independent companies, the small ones, that have a service arrangement with the Bell lines?

A. We have something like a million, well, nearly a million and a half of telephones of the independents—what we might call independent—companies, that are under contract under connecting relations—that is, on sub-licenses—and a great many of these are equipped with their own instruments. But they are small companies, and whatever toll business they do is over a limited area or limited districts, and in nearly all cases where they do happen to have use for long-distance connections themselves, we put in a special loop connecting the long-distance service.

Q. You have said that intercommunication is possible. What are the business objections, if any?

A. Well, our principal method of objection, of course, is that it would give a competing exchange advantage of our big system without any corresponding advantage to us, a system that we built up and maintained, oftentimes at a loss to ourselves. We have a large system extending over the United States, and perfectly connected, and if a competing exchange in the town should have all the advantages we have, there would be no corresponding advantage to us.

Q. You don't think you could charge them enough?

A. Why, of course we could charge them enough. Then, that would make it impracticable.

Q. From what standpoint impracticable?

A. Well, from the public standpoint. The exchange; they would go to the company that gave the facilities.

Q. Then there would be no harm in it?

A. No, there is no such thing as competing telephones—competing exchanges. There are no two exchanges in the same town giving the same service. It is not like a gas company, where you go and tap the main and get gas just as well. An exchange in a town is made up of, say, a thousand subscribers, and a competing exchange is made up of another thousand. Now there may be five or six hundred in that thousand that are common, because they want to be represented in all the exchanges. But to most of the people it is not competing, because they get an entirely different thing; they get connection with from number one to one thousand, and the other exchange gives connection from number three hundred to thirteen hundred. So it is not competition in the broad sense of the term between gas and electric light companies, where it does not make much difference when you turn on your light which company you have. A duplication of exchanges means necessarily great waste, because there is absolutely no salvage in a duplicate exchange, absolutely none. From fifteen to twenty-five per cent is about our estimate as to what, if we put two establishments together, we would save of the rest that is absorbed. The rest is absolute waste, and some one has got to pay for that.

Q. Your idea being, then, that the depreciation, the cost of operation, the interest charge of the cost of two exchanges would increase the burden upon the people of any community where there is competition?

A. It does, directly or indirectly. It either increases the burden in the way of rental or charges for the service, or it increases the burden in the way of capital invested, which means no return. Now, of course, in one case one set of individuals suffer the loss, and in the other case the others. Some one is bound to suffer where there is a duplication of plants.

Q. You are referring now, of course, to telephone plants?

A. Yes, sir.

Q. That is true of any public service corporation, isn't it?

A. I think so, as a rule.

Q. What do you say as to whether or not a telephone system in any given community should be a monopoly?

A. Of course, I naturally favor a monopoly, because I think the telephone is a natural monopoly.

Q. What do you say as to whether or not if it is permitted to be a monopoly, it should be regulated or controlled by the government, either state or national?

A. That depends entirely upon the nature of the regulation.

Q. State how far you think it should be regulated?

A. No one has any objections to proper supervision. In fact, I think nearly everybody would welcome it. But there are different methods of regulation.

Q. Do you think it should be regulated as to the character and quality of the service it renders?

A. If the company did not have enough interest in its own business and in its own welfare to render good service, I think it would be practically beyond regulation.

Q. What do you say as to the public regulation of rates?

A. We never have had any great trouble so far where it has been looked into by disinterested people. But the great trouble about the question of rates is something that we ourselves have not solved. And the great trouble about public regulation of the rates would be that theories might be introduced that had not been tried out, and might be more or less destructive in one way or the other.

Q. These theories might be tried on your company at its expense, you think?

A. This might be the case. It has been in the past.

Q. What do you say would be a fair return from the capital under the circumstances outlined by you?

A. I think eight per cent on a public utility company is not an unreasonable return to be expected.

Q. Did you make any statement in regard to the advantages that would come to the public through the acquisition by the American Telephone and Telegraph Company of the Western Union stock?

A. I don't know what benefit would come from the acquisition of the stock, but I am very certain that the two companies working together as auxiliaries to each other can, if properly managed, bring great benefits to the public.

Q. In what way?

A. In the first place, a telephone and a telegraph business are entirely distinct businesses. For a telegraph company to go into the telephone business, it would have to have as complete and independent an organization as the telephone company itself has for the telephone business, because the operating methods are different. If the telephone company should go into the telegraph business, the conditions would be similar. There is nothing in the telephone business that could be used for telegraph business except the wires. Now it so happens that seventy-five per cent of the telephone trunk lines, and I suppose over fifty per cent of the telegraph wires, can be used for both purposes simultaneously. The only two points where the telegraph and telephone come together are in the construction of the poles and of the lines. The moment the lines are strung the differences commence. A telegraph circuit is a grounded circuit running over the poles direct from one point to the other. A telephone circuit consists of two wires, and these two wires have to be transposed at frequent intervals, in order to prevent induction. You could telegraph from a telephone circuit, but you could not telephone from a telegraph circuit, except by introducing the same combination. You can take two telegraph wires and make a telephone circuit of them. You can take one telephone circuit and make four telegraph circuits by duplexing and quadruplexing. Two wires are necessary for the telephone circuit, and so the utilization of these, as I say, unutilized facilities is a very important thing, because the capitalization necessary for the duplication of the plant would be saved. But that in my opinion is the smallest advantage.

The trouble about telegraphing is the delay in getting the message to the telegraph office and getting it away from the telegraph office to the subscribers. Now, I believe that by the use of the telephone and certain appliances we can put almost every subscriber—certainly every subscriber who has any business to warrant it—in direct connection with the telegraph office, so that there is absolutely no time lost at all. If you want to send a message that does not particularly require you to be present, instead of waiting around to get the return, you simply tell your secretary or clerk to send a message so and so. Now, if that can be dropped right into the station, you have almost instantaneous service. I believe this can be accomplished to a very great extent. It has always been my idea since we started, and that is the reason why, in building our telephone system, we try to get a national system, so that some day or other we could adopt a standard form in connection with telegraphing. To a certain extent we do this today. A good many people telephone their telegraph messages and have their messages telephoned to them; but there is no responsibility, due to the different interests, and it is not satisfactory.

Q. Is it your idea that the telegraph company will compel people to receive messages over the telephone, or become subscribers of the telephone company, or else be charged for the delivery of their messages?

A. You can not compel any one to become a subscriber of the telephone company. However, nearly everybody who receives messages is a subscriber.

Q. In case a person is not a subscriber

must he pay for the delivery of the message or put in a telephone?

A. I am not in the telegraph business, so I can not tell you.

Q. You were elected a director of the Western Union Telegraph Company yesterday, I believe?

A. Yes, but I should say that the rule would apply that within reasonable distance delivery would be made free, and of course, beyond certain distances messages would naturally be charged for.

Q. That is, you have no idea at present of charging people for the delivery of messages where they are now delivered free?

A. Certainly not.

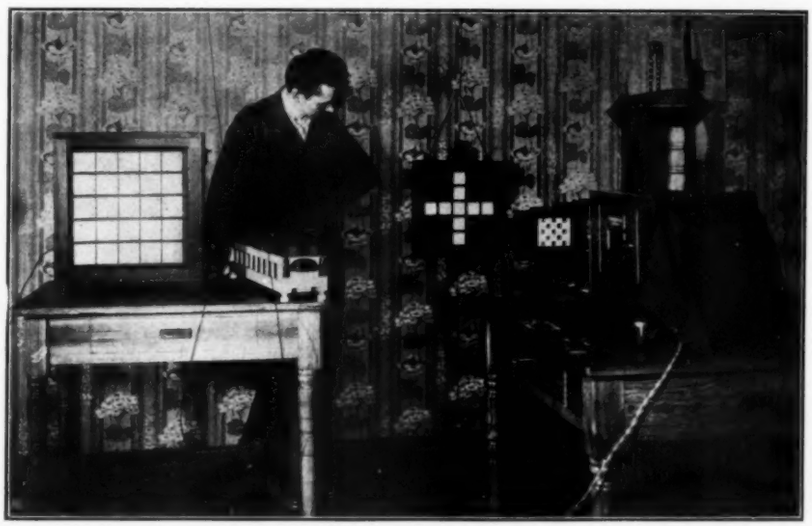
Telephoning Great Distances.

The distance attainable in telephonic transmission of speech, especially through cables, is limited not so much by the weakening of the current as by its alteration, which makes the voice unintelligible after a certain distance. The telephone current is a periodic current, which may be decomposed into several harmonics differing from each other in frequency, amplitude and phase. These harmonics are propagated independently of each other, and it is therefore easy to account for the alteration of the telephone current, even quantitatively. An artificial increase in the self-induction of the line greatly reduces not only the weakening of the telephone current, but also its alteration and permits a considerable increase in the distance of transmission.

In a communication to the French Academy of Science, Vasilesco Carpen states that in certain cases it would be of advantage to apply the processes of wireless telephony to transmission through wires—that is, to employ regularly maintained waves of a single, well-defined frequency produced by a singing arc or high-frequency alternator. The same processes that are employed in wireless telephony would also be utilized for receiving. There being only one frequency, the voice would no longer be distorted, but only weakened, and the distance of transmission could be greatly increased. The difficulty of producing the waves would be smaller than in wireless telephony, for the frequency need be barely sufficient to follow the modulations of the voice by varying the amplitude of the waves, but high enough not to affect the telephone receiver directly. However, the simplicity of ordinary telephony would be lost in this process and furthermore the damping, if it be the same for all sounds composing speech, becomes greater, especially on account of the increase in the apparent resistance of the line for frequencies of the order of 15,000. It would therefore be advantageous to employ a relatively low frequency, say, 5,000, for instance, but this does not seem possible *a priori*. The utilization of waves for multiple telephony has been already proposed. The syntonized receivers could be made as sensitive as possible without danger of being influenced by accidental disturbances in the line.—*Abstracted from L'Industrie Electrique, Paris, December 10, 1909.*

The Ruhmer System of Television.

The first "Elektrische Fernseher," built by Ernst Ruhmer, consisted of sixteen elements, each of one square millimetre in area, provided with a corresponding number of selenium cells. This apparatus was found to be so successful that a larger apparatus having twenty-five elements was built, and this has been successfully employed for transmitting pictures in the form of geometrical figures.



THE RUHMER TELEVISION APPARATUS.

It is maintained that while using this as a unit and providing 400 similar groups of selenium cells any picture can be transmitted to a distance, giving a faithful reproduction at the receiving station.

On account of the excessive cost of the 10,000 selenium cells required for use, such an installation on a large scale, only a great exposition could undertake its construction.

As the telephone was the great feature of the Philadelphia Worlds' Fair and the electric transmission of power a distance of 175 kilometres from Laufen the attraction at the Frankfort Exposition in 1891, and the use of Niagara Power at Buffalo the drawing card of the Pan American Exhibition, it is held that the great feature of the "Brüsseler Weltausstellung" will be the Ruhmer phototelegraphic apparatus, costing a million and a quarter dollars or five million marks.

The receiving apparatus of the Ruhmer "Fernseher" is shown at the left in the accompanying illustration, provided with a storage battery of twelve volts, noted at the edge of the table. The transmitting apparatus is seen at the right, consisting of an electrical stereopticon which throws the design on the screen appearing in the background of the illustration, the latter being divided into twenty-five square sections with a highly sensitive selenium cell arranged behind each section.

This transmitting apparatus responds almost instantaneously to any variation in lighting to which it is exposed, and it is stated that inertia has been entirely eliminated in this mechanism.

A similar screen is utilized at the receiving station having the same number of sections. Each of these sections is connected with a section on the transmitting screen, and a highly sensitive mirror galvanometer is provided which is effected by the fluctuations of current produced by the varying intensity of light on the transmitting screen.

By means of this television apparatus a reproduction is obtained on the receiving screen corresponding to a perforated pattern which is inserted in the electric projector or lantern, the focusing arc lamp producing a powerful light which is projected on to the transmitting screen, reproducing the pattern enlarged as inserted in the stereopticon.

The light thrown on the transmitting screen effects the resistance of the selenium cells and thereby changes the amount of current flowing through the connecting wires to the sensitive mirror galvanometers of the receiving screen.

The enormous labor and expense in constructing a complete apparatus for television consisting of 10,000 elements can hardly be realized. Herr Ruhmer has designed many forms of photo-electric selenium cells and has made many inventions in the field of wireless telegraphy, wireless telephony and tele-photography.

Mackay Inspects Southern Lines.

On his return from an inspection tour of the southern telegraph lines, Clarence H. Mackay expressed himself as being thoroughly satisfied with the situation and outlook. Mr. Mackay said in part:

"If the telegraph business is a barometer the South has lost none of the impetus that began before and continued in a modified degree through the panic. The people there have become philosophical, as well as prosperous, and do not easily get excited. We began to make plans for extensions, enlargements and general expansion of facilities throughout the South more than a year ago, and the net outcome of my visit is that we shall go ahead as demands require in all directions.

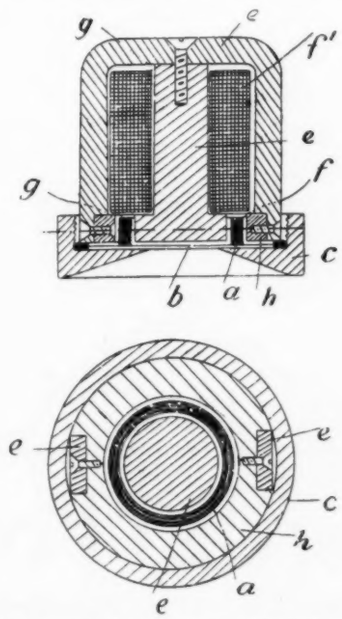
"Pending decisions by the Supreme Court may be and doubtless are important, proposed legislation in Congress may or may not be enacted, but what of it? Properties are not going to be confiscated and the country is not going to smash. On the contrary, we have only to rid ourselves of silly apprehensions of wanton official assaults upon legitimate business to enjoy the general prosperity which conditions warrant."

Telephone System of Uruguay.

United States Consul F. W. Goding supplies the following telephone statistics for Uruguay: Montevideo Telephone Company, 10,727 miles of wire, 4,105 telephones, 227 employes, 4,036 telephone stations in city; charge per month—office $4.86, residence $4.14; country lines, 1,040 miles of wire and 558 stations. Co-operative Telephone Association of Montevideo, 4,500 miles of wire, 94 employees, and one central station and ten substations in city and country.

The Marcer Telephone.

This new telephone has been invented by a Spanish professor, Dr. Pedro Marcer. Its operation is based on the principle of electromagnetic reaction, by reason of which a conductor traversed by a current and located in a magnetic field is subjected to an effect proportional to the relative intensities of current and magnetic field, as well as of its length. If, therefore, a coil to which a vibrating diaphragm is fastened be mounted in a magnetic field and the coil traversed by the vibrating currents emanating from a microphone, the coil becomes in turn the seat of a series of vibrations and transmits them to the diaphragm which emits the sounds produced before the microphone. In the Marcer telephone the amplitude of the sounds emitted depends on the intensity of the magnetic field, which may be easily modified at will, and the receiver adapted to the special conditions of any case. The accompanying diagram shows the receiver in cross section. A small coil *a* with terminals *f g*, is surrounded by a small iron ring *h* and a thin diaphragm *b* of carbon, wood or mica, etc., is attached to it. By fastening the diaphragm at its border and screwing on the cover *c*, all the essential conditions for obtaining a telephone receiver based on the new principle are realized. It is preferable that the electromagnet be completely saturated in order to increase the attraction and repulsion of the annular coil, and this may be done by a local current. In the figure, *e* is the core of the electromagnet, *f* its coil and *e'* a piece of U-shaped soft iron screwed to the core.—*Abstracted from L'Electricien, Paris, January 1, 1910.*



CROSS-SECTION OF THE RECEIVER OF THE MARCER TELEPHONE.

Telephone Inquiry Ends.

The inquiry on behalf of minority stockholders of the United States Telephone Company, of Ohio, and other independent lines into the sale of the lines to J. P. Morgan & Company came to an abrupt end on February 17. Henry P. Davison, of P. J. Morgan & Company, and Theodore N. Vail, president of the American Telephone and Telegraph Company, had been cited to appear as witnesses when Clarence Brown, of counsel for the American Telephone and Telegraph Company, received a message from Harrison B. McGrawn, counsel for the minority stockholders, notifying him that there would be no further inquiry. It is inferred here that the minority stockholders believed they had sufficient evidence on which to base a new action under the Federal courts or the Interstate Commerce Commission, but this could not be substantiated, as all the parties were in Cleveland, Ohio.

It was contended by the minority stockholders that the sale of the independent companies to Morgan & Company was in effect a transaction to give the American Telephone and Telegraph Company control of these telephone lines.

Commercial Cable Company to Lay a Sixth Cable.

George G. Ward, vice-president and general manager of the Commercial Cable Company, announces that in view of the public demand for increased cable facilities and greater speed of transmission the Commercial Cable Company will proceed at once to lay an additional transatlantic cable. This will be the sixth cable which the Commercial Cable Company will own between Europe and America, and will greatly accelerate the transatlantic cable service.

More Pay for Telegraphers.

An increase of ten per cent in salaries has been granted by the Western Maryland Railroad to its telegraphers. More than 300 operators will be affected by the advance.

Multiple Telephony.

By the employment of alternating currents as carrier of the delicate microphone currents—that is, of high-frequency currents brought into resonance with the conductor system—it is not only possible to remove the disturbing properties of long lines or cables, but multiple telephony may also be practised, says August Maior. A circuit arrangement permitting the practice of multiple telephony in an easy manner by means of alternating currents is shown in Fig. 1. E is a high-frequency current machine, M_1 and M'_1 are the microphones, T_1 and T'_1 the telephones of station I; Z_1 and Z'_1 are electric valves arranged in the branches of the station I in such a way that one cell allows the passage of one-half wave and the other cell of the other half wave of the alternating current. At station II telephones and microphones are arranged so that the upper and lower branches of both stations, respectively, correspond to each other; at station II the valves are arranged in such a way that through Z_2 there will pass half waves coming from Z_1, and through Z'_2 only half waves from Z'_1. The microphone currents superimposed on the high-frequency currents in branch a can, therefore, be heard in branch A; those in branch b can be heard in branch B, and vice versa. Any device producing a rectifying effect may be be used as a valve, but electrolytic valves are recommended on account of their cheapness and simple manipulation. The method explained permits the simultaneous carrying on of four conversations by means of two alternating currents of different frequencies, if the principle of electric resonance is utilized. The difference in the periods of vibration most favorable for such transmission must be ascertained by experiment. The circuit arrangement is shown in Fig. 2, L_1 and L_2 being self-inductions, C_1 and C_2 capacities, by means of which groups A and B are brought into resonance with the alternating-current sources. The method here described may also be applied to multiple telegraphy; in this case the current need not be of very high frequency, and a current interrupter may also be used. The imperfect valve effect and not always constant capacity of the cells sometimes give rise to disturbances in duplex telephony, but the author hopes to remove these and is carrying on experiments with this end in view.—*Abstracted from Elektrotechnische Zeitschrift, Berlin, September 23, 1909.*

FIG. 1. — CIRCUIT ARRANGEMENT FOR DUPLEX TELEPHONY.

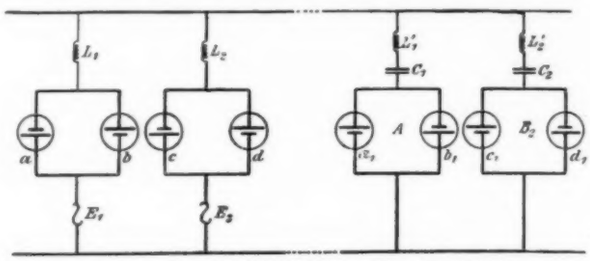
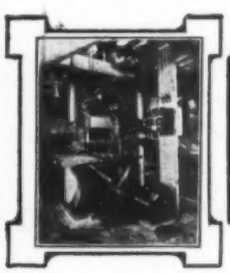
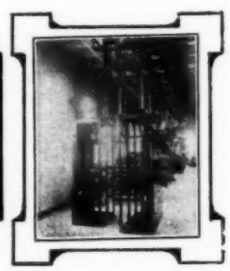


FIG. 2.—CIRCUIT ARRANGEMENT FOR MULTIPLE TELEPHONY.



Industrial Power



LOW MOTOR SPEEDS BY MOTOR-GENERATOR DRIVE.—II.

PRINTING PRESS MAKEREADY SPEEDS.

BY S. H. SHARPSTEEN.

If two sets of fields and two armatures are used in the motor-generator set, it is quite an easy matter to vary the field strength of the motor end of the motor-generator and get exactly the press plating and threading speed desired without resistance in circuit with the armature of either the driver or drivers.

Fig. 2 is a wiring diagram of this system as it might be used with manual control for printing presses, where it would be advisable to have but one controller arm.

There should be a contactor or solenoid switch with non-arcing contacts in the armature circuit AC, AC^1 and AC^2. This is also true of the other two armature circuits especially where large pressures are to be driven. For small press equipments a contactor could be placed in the controller for opening and closing the main circuit.

The automatic or push-button part of the control for emergency stop and for slowly moving the press could be arranged in a similar manner to that described in the article on "Slow-Speed Drive of Single-Motor Web Presses," which appeared in the ELECTRIC REVIEW AND WESTERN ELECTRICIAN of April 17, 1909.

Let A represent the large motor armature and A^1 the armature of the motor-generator. If it be a web press installation, when ready to run for threading, the service switch SS being closed, the arm H would be slowly moved to the right until controller brush C^3 touched controller dial D^3 when the field of the motor-generator would be excited. The field wiring which would be standard is omitted to save complication. Next the controller brush C^2 should make contact with point 1 in the controller dial D^2, when the motor-generator would start. Then as controller brush C^4 made contact with dial D^4, the contactor CT would close the circuit AC^3, AC^4, and AC^5, passing low-voltage current from the motor-generator armature A^1 through the armature A, and causing the press to turn when the arm H cut sufficient resistance out of dial D^2 to

cause the motor-generator to force sufficient energy through the large motor. As the arm H passes to the right when C^1 touches dial D^1, the field of the large motor is excited. The field wiring, being standard, is omitted. Just before the controller brush C touches the first block of armature dial D, C^4 leaves D^4 compelling contactor CT to open the armature circuit AC^3, AC^4, and AC^5, and later when the main armature circuit is closed it takes the load. This prevents the higher line voltage from forcing current through the low-voltage circuit.

When the large motor first takes the load, the motor-generator will run free, but when C^2 leaves point 5, dial D^2, and C^3 leaves D^3, the motor-generator will cease to turn while the press is producing.

In some cases at least, with equipments of this nature now in use, if the paper breaks when the press is producing, and a low speed is desired, the controller is

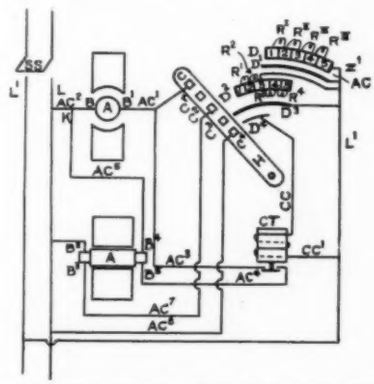


FIG. 2.—WIRING DIAGRAM FOR PRINTING PRESS DRIVE.

thrown to the off position and the motor-generator started to get a proper threading speed by the go-ahead movement of the controller arm.

Apparently there has been some difficulty in arranging the apparatus to get the slow speed by moving the controller arm H backward or toward the off position, but there is no apparent reason why, as the controller arm H comes back from the running position (when C^3 touches field dial D^3), the field of the motor-generator should not be excited, and when C^2 touches point 5, dial D^2, the motor-generator will not start; and as the resistances R^4, R^3 are cut out and the armature A^1 comes to speed, and when C leaves point 1, dial D, the brush C^4 should not touch D and close solenoid switch C and let the motor-generator take the load.

If the press speed were brought down slowly so that the press gears were kept tight together in a driving condition, the momentum of the small armature A should not prevent it from settling down to the proper working conditions if the windings and resistances R^1, R^2, etc.; and the resistances R', R'', etc., were properly designed and adjusted.

If the device that was used to open and close the circuit AC^3 and AC^4 were made interlocking with the arm H and compelled to act rapidly, it would prevent trouble that might occur at the change over from line to motor-generator current, or from motor-generator current to line current, and allow a quick passage over the point where there was no power driving the press.

Air-Nitrate Manufacture in Germany.

A Berlin correspondent of *The London Times* recently gave in that newspaper an account of a works which has just been erected at Patsch, near Innsbruck, in Germany, for electrically fixing atmospheric nitrogen by means of the process invented by H. and G. Pauling. Electric current will be generated in a hydroelectric plant on the River Sill.

The process is mainly based on the use of flame arcs produced between bent electrodes. In order now to keep flames of considerable energy burning constantly with a relatively low tension while considerable amounts of air are being blown through the interval betwen the electrodes, a special ignition device has been designed by the Salpetersäure - Industrie - Gesellschaft, which is working the Pauling process. The main electrodes at the point of shortest distance comprise a vertical slot through which can be introduced narrow knives (termed "lighting knives"). By means of a hand operated adjusting device these can be brought together till they are only a few millimetres apart. Being very narrow, they do not interfere with the motion of the air.

The main electrodes are so adjusted that an air current about 40mm. in width traverses the narrowest portion. This current, which has been preheated, is introduced through a nozzle which is so shaped as to cause it to diverge on issuing, and to surround the whole length of the electrodes.

The efficient length of the flame is about one metre. The electrodes are composed of iron; they are cooled with water, and are able to stand an average of 200 working hours. Owing to their small thickness the lighting knives burn away more quickly, and accordingly have to be adjusted from time to time to a given distance.

The furnace gases are cooled by means of what is called "circulation air," which is introduced sideways into the upper portion of the flame, thus ensuring a relatively rapid cooling of the gases. It is introduced at a lower speed than the main air current, and thus exerts on the electrical arc a suction effect, causing it to be drawn out and broadened.

Each set of two arcs is enclosed within a masonry furnace. The present type of furnace takes 400 kilowatts at a tension of about 4,000 volts, 600 cubic metres of air per hour traversing the furnace apart from the circulation gases. Twenty-four such furnaces are installed at the Innsbruck factory. Another type of furnace recently installed takes from about 1,500 to 2,000 kilowatts.

Electric Drive Economical in Textile Mills.

In a paper recently presented before the Calcutta Section of the Institution of Mechanical Engineers, it was pointed out that as power accounts for only about 2.5 per cent of the manufacturing costs in a textile mill, an increase of from three to four per cent in production which results from the steadier electric drive would practically wipe out the total fuel cost of the mill.

Try-Out for Reduction Gear.

The Melville and Macalpire reduction gear has already received official recognition in the United States navy. It is stated on good authority that the *Baltimore* may be re-engined with steam turbines of 12,000 horsepower, direct-connected to the propellers through reduction gearing of the new type, and that one of the projected 6,000-horsepower colliers may be similarly equipped.

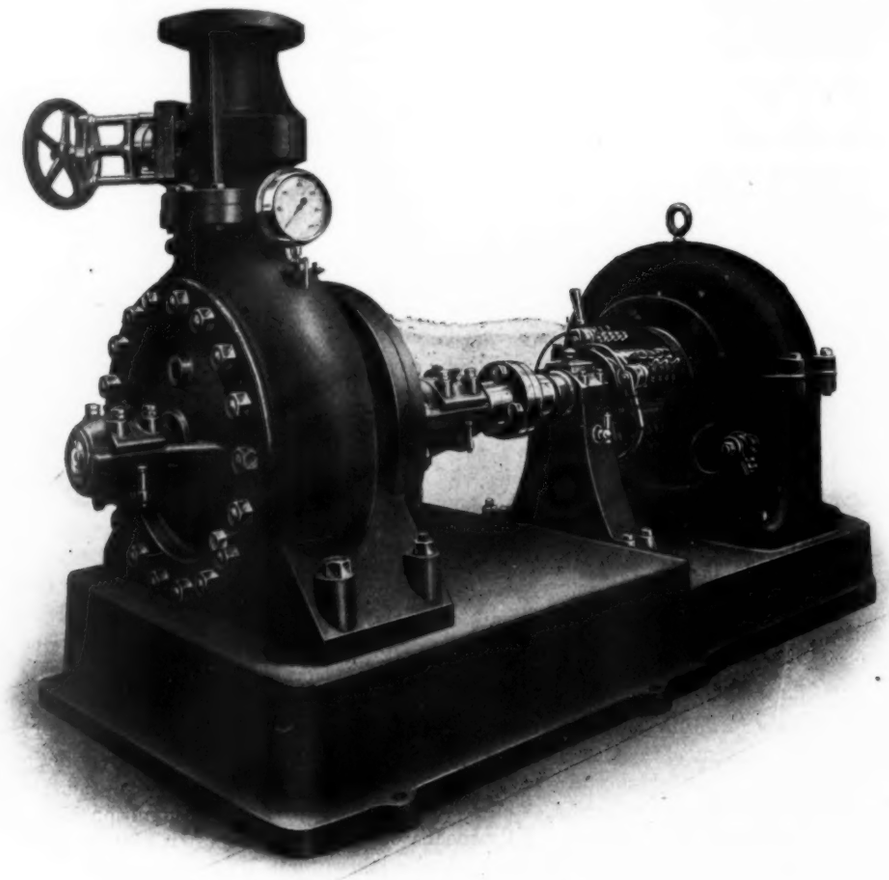
A Good Move.

City Electrician L. G. Smith, of Kansas City, Mo., is asking for an ordinance to extend the district in which the wiring in buildings must be enclosed in steel pipes. The measure, which is for increased fire protection, has good backing and will probably be passed.

ELECTRICALLY DRIVEN PUMPS.—IX.

AN ENGLISH PUMP DESIGNED FOR DIRECT ELECTRIC DRIVE.

The type of pump described and illustrated herewith has been designed both for high and low lift purposes, and is thus available for mine and similar work, in the first instance, and for circulating pumps for condensing plants, etc., in the second. This pump was designed by Orten Boving, the well-known English pump expert, for the firm of Willans & Robinson, Limited, of Rugby, England, and is known as the Victoria turbo-pump.



THE VICTORIA TURBO-PUMP DIRECT-CONNECTED TO ELECTRIC MOTOR

The pump has been designed on lines which will enable it to be manufactured accurately and cheaply, in view of the fact that machine work enters principally into its construction, and it follows therefore that the individual parts of the pump can be manufactured to gauge and in standard sizes.

The high-lift pumps are being built to deal with heads of some 2,000 feet, whilst the low-lift pumps are arranged for pumping against heads of some fifty to sixty feet or less.

The principal points to which attention might be drawn are as follows:

One of the most fruitful sources of trouble in high-lift pumps is the pressure gland at the delivery end. To avoid undue leakage these glands have to be screwed up very tight, and the pressure of the packing material on the shaft causes very considerable wear, and also loss of efficiency amounting to as much as seven per cent. The pump in question has no pressure stuffing box, as only low pressure exists in the end chamber behind the last diaphragm. This feature of the design removes one of the most fruitful sources of trouble and annoyance to a pump user. The stuffing box at the suction end is water-sealed, and as it has only to hold tight against one-tenth of an atmosphere, there is no necessity to set the packing hard against the shaft.

The end thrust is balanced by a special patented arrangement of extreme simplicity, and this automatically adjusts itself for changes of head and output while the pump is running, and for any wear that may take place in the impellers.

The bearings are separated by a gap of an inch or two from the packing, thus preventing the entry of grit, mud, or water.

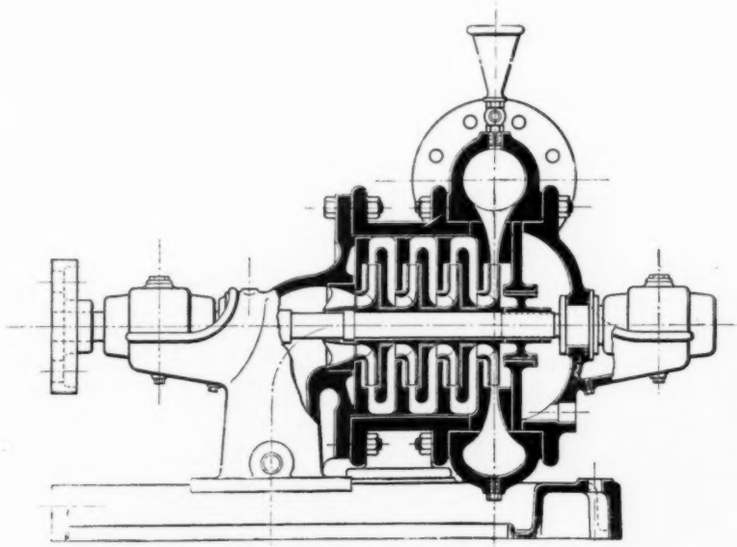
The bearings are cast in one piece with the end covers, and these latter fit cylindrically into the center casing. It is therefore impossible for any part to get out of alinement if the pump is dismantled.

The bearings are arranged for ring lubrication. In the case of sinking pumps the bearings are arranged to be supplied with oil under pressure.

The central casing is of cylindrical bore, and the guide wheels and diaphragms fit cylindrically into the casing. The dismantling and re-assembling of the sundry parts is therefore an extremely easy matter, as they have only

to be pushel in one after the other from the open end.

The impellers and guide wheels are all made of special bronze, and the inner surfaces of the impeller and guide wheel channels are carefully finished throughout either by machine or by hand, so that the water during its whole passage through the pump from the first impeller to the delivery casing never comes in contact with any rough surface. The finish of these parts is an important point as experience has shown that the wheels treated in this way have a much longer life when dealing with gritty or muddy water than those having unfinished channels. The central casing of the



CROSS-SECTION OF THE VICTORIA TURBO-PUMP.

pump is in all cases lined with special bronze, so that no acid or gritty water comes into contact with the casing itself at any point.

Several tests which have been made, and the results of which have been published in the British technical journals, have shown high efficiencies for this type of centrifugal pump.

(To be continued.)

Reducing Friction Losses.

In a recent paper before the American Society of Mechanical Engineers, Henry Hess gave particulars of some of his tests on the use of ball bearings for shafting. These gave a saving in power of from 3.5 to 21.0 per cent when ball bearings were used on the line shafting only, and of double these figures when the countershafts were also so equipped.

The Latour Compound Alternator.

The problem of automatically regulating the tension of the current supplied by an alternator, at all loads and for all values of the power factor, has been solved in a practical manner by the Latour compound alternator. Employed in connection with the same is a special Latour exciter, the tension at the terminals of which is automatically brought to the compounding or hypercompounding value by the following arrangement: The exciter D, Fig. 1, produces direct current which is collected by brushes at an ordinary commutator C, and sent through inducing coils F, of the three-phase alternator A. The exciter is furthermore provided with two collector rings B B′, which are connected to the secondary by means of brushes b b′. This special exciter constitutes a converter, the function of which is to transform alternating into direct current and vice versa, or to produce simultaneously direct and alternating current. It has the same frequency as the alternator, is keyed to the shaft of the same and has an equal number of holes, so that on the shaft of the same and has an equal number of holes, so that on open circuit the two machines are in phase. Another feature of the exciter is a compensating winding located in the poles themselves, Fig. 2, and traversed by the induced current, which establishes uniformity of flux under the poles and insures good operation with a fixed position of the brushes under all conditions; in other words, the effect of this winding is to annul the magnetic reaction of the secondary. The alternator, A, Fig. 1, ordinarily a three-phase machine, is equipped with a supplementary winding S of a few turns in the slots of the alternator. Simple alternating current flows through this compound winding and the secondary of a transformer T R to the

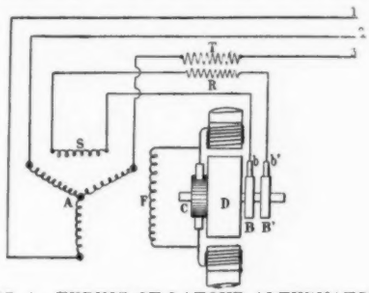


FIG. 1.—WIRING OF LATOUR ALTERNATOR.

rings B B′ of the exciter. The primary T of the transformer is traversed by the current of one of the phases of the alternator, and the secondary R by the compound current produced by the supplementary single-phase winding of the stator of the alternator. This compound current is theoretically zero if the characteristics of the exciter are suitably chosen and the preliminary regulation is well made. The operation of the system is as follows: Assuming in the beginning brushes b b′ to be removed and the alternator generating a certain current at normal pressure, then the current of one of the phases traversing the primary T of the transformer generates in the secondary an alternating electromotive force ninety degrees behind the flux and consequently behind the phase current. This electromotive force is therefore in phase with the induced current, and the transformer is constructed so that the electromotive force remains proportional to the tension of the induced current.

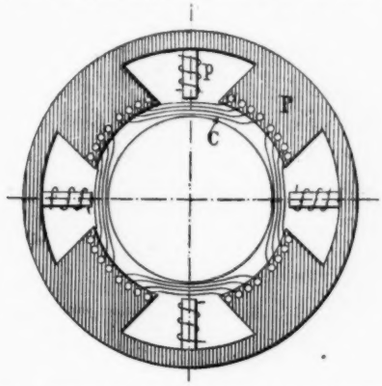


FIG. 2—FIELDS OF LATOUR ALTERNATOR.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

TOLEDO RAILWAYS AND LIGHT.

The report of the Toledo Railways and Light Company for the month of December and twelve months ended December 31, 1909, compares as follows:

	1909	1908
December gross	$ 263,400	$ 235,974
Expenses	136,305	120,356
December net	$ 127,095	$ 115,618
Other income	152	93
Total income	$ 127,247	$ 115,711
Charges and taxes	75,927	72,125
December surplus	$ 51,320	$ 43,586
Twelve months gross	2,730,396	2,538,633
Expenses	1,526,120	1,377,022
Twelve months net	$1,204,276	$1,161,611
Other income	2,781	3,477
Total income	$1,207,057	$1,165,089
Charges and taxes	879,503	851,782
Twelve months surplus	$ 327,554	$ 313,307

MONTREAL STREET RAILWAY.

The report of the Montreal Street Railway Company for the month of January and four months ended January 31 compares as follows:

	1910	1909
Jan. gross	$325,621	$295,453
Expenses	205,060	199,644
January net	$120,651	$95,809
Charges, taxes, etc.	35,690	33,536
January surplus	$84,871	$62,273
Four months gross	1,352,062	1,230,524
Expenses	791,939	748,839
Four months net	$560,123	$481,685
Charges, taxes, etc.	132,035	124,105
Four months surplus	$428,088	$357,580

AMERICAN LIGHT AND TRACTION.

The American Light and Traction Company has issued its annual report for the year ended December 31, 1909. The earnings compare as follows:

	1909	1908
†Earnings	$3,033,668	$2,452,873
Miscellaneous earnings	311,772	270,191
Gross earnings	$3,345,440	$2,723,064
Expenses	106,261	45,000
Net earnings	*$3,239,179	$2,678,064
Dividends	1,632,666	1,349,254
Surplus	$1,606,513	$1,328,810
Surplus and reserve previous year	5,683,137	4,354,327
Total surplus	$7,289,650	$5,683,137
Stock dividend	1,290,585	
Total surplus	$5,999,065	$5,683,137

†Earned on stock of subsidiary companies owned.

*After allowing for 6 per cent on the $14,236,200 preferred stock outstanding, the balance, $2,385,007, is equal to 25.42 per cent earned on the $9,383,000 outstanding common as against 24.2 per cent earned on $7,516,900 outstanding common stock last year.

WASHINGTON, BALTIMORE & ANNAPOLIS.

The Washington, Baltimore & Annapolis Electric Railway Company reports gross earnings for December $44,580, a decrease of $1,732 as compared with December last year; net after expenses and taxes amounted to $11,683. For six months ended December 31, 1909, gross $324,373, net $113,108. The total deficit of the company on December 31, 1909 (November and December deficit after charges estimated), amounted to $212,696.

PACIFIC TELEPHONE AND TELEGRAPH.

The Pacific Telephone and Telegraph Company has issued its report for the year ended December 31, 1909, which compares as follows:

	1909	1908
Gross revenue	$12,885,018	$10,699,650
Exp taxes, interest, etc.	11,041,489	8,924,179
Net revenue	$1,843,529	$1,775,471
Dividends	1,080,000	1,080,000
Balance	$763,529	$695,471
Maintenance reserve	600,000	
Surplus	$163,529	$695,471

*Balance for common dividends, after payment of 6 per cent on preferred stock, is equal to 4.24 per cent earned on $18,000,000 common stock, as compared with 3.8 per cent earned on same stock last year.

NIAGARA FALLS POWER COMPANY.

The annual report of the Niagara Falls Power Company and the Canadian Niagara Power Company for the year ended December 31, 1909, is issued. The combined income account compares as follows:

	1909	1908
Gross	$1,952,348	$1,681,941
†Expenses	431,297	422,617
Net	$1,521,051	$1,259,324
Other income	134,078	88,704
Total income	$1,655,129	$1,348,028
Fixed charges, etc.	1,200,635	1,190,737
Surplus	*$454,492	$157,191

*Equal to 10.82 per cent on the $4,200,00 outstanding capital stock ($2,500 of above amount being stock of the Canadian Niagara Power Company.) †Includes $100,000 appropriated as a reserve fund in respect of obsolescence, in adequacy and as a reserve against extraordinary casualities.

DETROIT UNITED.

The report of the Detroit United Railways Company for the month of January compares as follows:

	1910	1909
January gross	$659,582	$559,160
Expenses	425,761	254,696
January net	$233,831	$204,464
Other income	12,161	11,846
Total income	$245,952	$216,310
Charges and taxes	158,658	153,702
January surplus	$87,334	$62,608

NATIONAL CARBON.

The National Carbon Company has issued a report for eleven months ended December 31, 1909, which compares as follows with statement for twelve months ended January 31, 1909:

	1909	Increaes.
Net earnings	$1,211,438	$231,155
Preferred dividends	†236,250	*78,750
Balance	$975,188	$309,905
Common dividends	261,250	41,250
Balance	$713,938	$268,655
Deprec., etc.	296,323	*100,696
Surplus	$417,615	$379,351

*Decrease. †Includes three quarterly dividends only.

WINNIPEG ELECTRIC STREET RAILWAY.

The Winnipeg Electric Street Railway Company has issued its report for the year ended December 31, 1909, which compares as follows:

	1909	1908
Gross earnings	$2,023,731	$2,206,095
Operating expenses	720,665	1,088,873
Net earnings	$1,303,066	$1,117,222
Fixed charges	439,661	371,819
Balance	$863,405	$745,403
Dividends	600,000	595,789
Surplus for year	$263,405	$149,614
Previous surplus	598,024	448,410
Total surplus	$861,430	$598,024

CHICAGO RAILWAYS COMPANY.

The Chicago Railways Company has issued its report for the year ended January 31, 1910 (January being partly estimated), which compares as follows:

	1910	1909
Gross income	$12,438,052	$11,037,071
Operating expenses, 70 per cent	8,706,637	7,725,950
Balance	$3,731,415	$3,311,121
Interest, 5 per cent on valuation	2,275,718	1,739,684
Balance for distribution	$1,455,697	$1,571,437
City's proportion, 55 per cent	$800,633	$864,290
Company's proportion, 45 cent	$655,064	$707,147

WASHINGTON RAILWAY AND ELECTRIC.

The Washington (D. C.) Railway and Electric Company has issued its report for the year ended December 31, 1909, which compares as follows:

	1909	1908
Gross earnings	$4,080,064	$3,720,573
Operating expenses	2,110,579	1,856,171
Net earnings	$1,969,485	$1,864,402
Other income	10,602	37,525
Total income	$1,980,087	$1,901,927
Fixed charges	1,230,292	1,177,491
Balance	$749,795	$724,436
Preferred dividends	425,000	425,000
Surplus	$324,795	$299,436

LONDON UNDERGROUND.

The Associated Companies of the London Underground Electric Railways Company report for the month of January compared as follows:

	1910	1909
Metropolitan District Railway:		
Gross receipts	£57,130	£51,886
Working expenses	26,772	30,362
Net receipts	£30,358	£21,524
Baker Street & Waterloo Railway.		
Gross receipts	£16,804	£16,281
Working expenses	7,721	7,266
Net receipts	£9,083	£9,615
Great Northern, Piccadilly & Brompton Railway:		
Gross Receipts	£29,796	£27,795
Working expenses	14,277	14,316
Net receipts	£15,659	£13,479
Charing Cross, Euston & Hampstead Railway:		
Gross receipts	£17,287	£17,752
Working expenses	9,918	9,827
Net receipts	£7,369	£7,925
London United Tramways, Ltd.:		
Gross receipts	£23,753	£22,321
Working expenses	17,748	17,308
Net receipts	£6,005	£5,013
Total all companies:		
Gross receipts	£144,770	£136,035
Working expenses	76,386	79,079
Net receipts	£68,384	£56,956

INTERBOROUGH RAPID TRANSIT.

The Interborough Rapid Transit Company has issued a statement of earnings covering the seven months ended January 31, 1910, which compares as follows:

	1910	1909
Gross operation revenue	$16,512,297	$14,861,638
Operating expenses	6,349,577	6,313,254
Net operating revenue	$10,162,720	$8,548,384
Taxes	985,662	1,075,806
Income from operation	$9,177,057	$7,472,577
*Other income	258,953	576,953
Total income	$9,436,010	$8,049,531
Int., rentals, &c, includ Manhat. Guar.	6,159,073	6,063,054
Surplus	$3,276,937	$1,986,476
Dividends	1,837,500	1,837,500
Surplus	$1,439,437	1,837,500
Pass carried (7 mos)	320,560,226	287,947,482

*The decrease in other income is largely due to the policy inaugurated July 1, 1909, of not crediting to income the interest upon the advances made for the construction of the New York & Long Island Railroad Tunnel.

UNITED RAILROADS, SAN FRANCISCO.

The United Railroads of San Francisco report for the year ended December 31, 1909, compared as follows:

	1909	1908
Gross earnings	$7,455,965	$6,866,302
Operating expenses	4,242,649	4,242,750
Net earnings	$3,213,316	$2,623,552
Other income	174,126	123,271
Total income	$3,387,442	$2,746,823
Charges	2,982,970	2,773,813
Surplus	$440,472	*$26,989

*Deficit.

GEORGIA RAILWAY AND ELECTRIC.

The Georgia Railway and Electric Company report for the year ended December 31, 1909, compares as follows:

	1909	1908
Gross earnings	$3,673,007	$3,339,021
Operating expenses	1,770,142	1,649,994
Net earnings	$1,902,865	$1,689,027
Other income	38,054	33,827
Total income	$1,940,919	$1,722,854
Charges and tax	845,242	833,402
Balance	$1,095,677	$889,452
Preferred dividend	120,000	120,000
Balance	$975,677	$769,542
Common dividend	510,876	510,876
Surplus	$464,810	$258,576

FORT WAYNE & WABASH VALLEY.

The report of the Fort Wayne & Wabash Valley Traction Company for the month of December and twelve months ended December 31, 1909, compares as follows:

	1909	1908
December gross	$ 129,719	$ 118,835
Expenses	73,027	64,737
December net	$ 556,692	$ 54,097
Twelve months gross	1,414,526	1,322,720
Expenses	821,722	737,134
Twelve months net	$ 592,803	$ 585,586
Charges and taxes	521,350	488,756
Twelve months surplus	$ 71,453	$ 96,830

BELL COMPANY OF PENNSYLVANIA.

The Bell Telephone Company of Pennsylvania reports gross earnings for the year ended December 31, 1909, of $11,696,032, an increase of $261,512. Surplus, after dividends, was $561,252, a decrease of $226,665. Subjoined are the figures, with charges from the previous year:

	1909	Changes
Gross earnings	$11,696,032	Inc. $261,512
Net earnings	3,308,852	Dec. 145,229
Balance after charges	3,054,232	Dec. 121,087
Dividends	2,493,000	Inc. 105,579
Surplus	561,252	Dec. 226,665

CUMBERLAND TELEPHONE.

The Cumberland Telephone and Telegraph Company has issued its pamphlet report for the year ended December 31, 1909. The full income account compares as follows:

	1909	1908
Gross	$6,615,368	$6,141,817
Expenses	3,879,439	3,662,972
Net	$2,735,928	$2,478,845
Charges and taxes	579,081	485,415
Surplus	*$2,156,847	$1,993,430
Dividends	1,574,412	1,476,011
Surplus	$ 582,435	$ 517,419
Previous surplus	3,286,202	2,768,783
Total surplus	$3,868,637	$3,286,202
Adjust. credit	100,530	.....
Profit and loss surplus	$3,969,167	$3,286,202

*Equal to 10.96 per cent on the $19,680,150 capital stock compared to 10.12 per cent earned on same stock last year.

The earnings and expenses, in detail, for the past few years compare as follows:

Gross earnings:	1909	1908
Exchange service	$4,535,289	$4,232,429
Tolls	1,861,009	$1,654,699
Other sources	219,070	254,689
Total	$6,615,368	$6,141,817
Expenses:		
General	$ 384,484	$ 366,435
Operating expenses	1,451,690	1,345,997
Maintenance, reconstruction, etc.	2,030,856	1,933,112
Real estate and miscellaneous expenses	12,410	17,428
Total	$3,879,440	$3,662,972

FALL RIVER ELECTRIC LIGHT COMPANY.

At the annual meeting of stockholders of the Fall River Electric Light Company, the financial statement presented for the year ending December 31, 1909, showed total assets of $1,228,469.36, with liabilities of $1,148,513.70, leaving a balance of $79,955.66. There was paid in dividends, $48,000—eight per cent. Philip Cabot of Boston was added to the board of directors to represent Boston stockholders and to fill a vacancy caused by the death of Rufus W. Bassett.

It was unanimously voted that for the purpose of reducing the floating indebtedness and providing for the construction of underground conduits and the extension of the distributing system, to increase the capital from $600,000 to $800,000, and to instruct the president, Jerome C. Borden, to petition the Massachusetts State Board of Gas and Electric Light Commissioners to authorize the increase. The Commissioners will fix the price at which the new stock is to be issued.

LOUISVILLE RAILWAY.

The Louisville Railway Company has issued its report for the year ended December 31, 1909, which compares as follows:

	1909	1908
Gross earnings	$2,890,303	$2,714,353
Operating expenses and taxes	1,881,406	1,725,003
Net earnings	$1,008,897	$989,350
Other income	78,829	44,202
Total income	$1,087,726	$1,033,552
Interest charges	385,385	380,210
Balance	$702,341	$653,342
Preferred dividend	125,000	125,000
Balance	$577,341	$528,342
Common dividend	545,650	524,817
Balance	$31,691	$3,525
Accident and equipment reserve	25,000	.....
Surplus	$6,691	$3,525

New York Telephone Changes.

The following changes in the board of directors of the New York Telephone Company were made on February 25: W. D. Sargent, of Brooklyn; ex-Governor Griggs, of Paterson, N. J.; James H. Manning, of Albany, N. Y.; John F. Maynard, Utica, N. Y.; William Nottingham, Syracuse, N. Y.; Benjamin E. Chase, Rochester, N. Y., and Henry M. Watson, Buffalo, N. Y., were elected directors in place of J. P. Davis, Charles L. Kingsley, George J. Gould, R. C. Clowry, J. C. Wilever, J. B. Van Every and B. Brooks, resigned. The retiring directors represented the Western Union Telegraph Company's interest in the board.

Theodore N. Vail was elected chairman of the board of directors, and U. N. Bethell was elected president of the company. Mr. Bethell has been identified with the telephone business since 1888.

Progress of Plans for New York Subway.

At a conference recently held in New York City between city officials and members of the Public Service Commission, it was practically decided to build the so-called Tri-Borough subway as soon as possible and with the city's funds.

This new subway is intended to furnish a new trunk line through Manhattan Island, with feeders opening up new territory in the Bronx and a connection with the Brooklyn system of subways.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Elevator Controllers.

The Cutler-Hammer Manufacturing Company, of Milwaukee, Wis., has recently redesigned its entire line of electric elevator controllers. As now constituted the series embraces three types of full magnet controllers for direct-current elevators and two full magnet controllers for alternating current, the various types providing suitable control for high speed and moderate speed passenger elevators and a simplified form of full magnet control for freight elevators.

Eight different types of direct-current, semi-magnet controllers are provided and four semi-magnet controllers for alternating current. The line includes, also, mechanically operated controllers suitable for use where the voltage of the line is extremely variable, reversing and non-reversing controllers for belt-driven freight elevators, and a compact drum-type controller for use with sidewalk lifts.

Among the elevator accessories which supplement the controllers are brake solenoids for both alternating and direct current, several types of limit switches, together with slack cable and safety switches.

The Cutler-Hammer line of alternating-current controllers is particularly interesting as indicating the increasing use of the induction motor in elevator service. Up to within a comparatively short time ago direct-current motors were almost invariably used for this class of work, but recently developments in the controller art have made it possible to employ the full magnet system of control with alternating-current motors also. It is stated that the polyphase brake solenoids used with alternating-current motors operating elevators are now practically noiseless, thus eliminating the annoying humming which was formerly a serious objection to the use of alternating-current controllers, particularly when installed in residences, office buildings or hospitals.

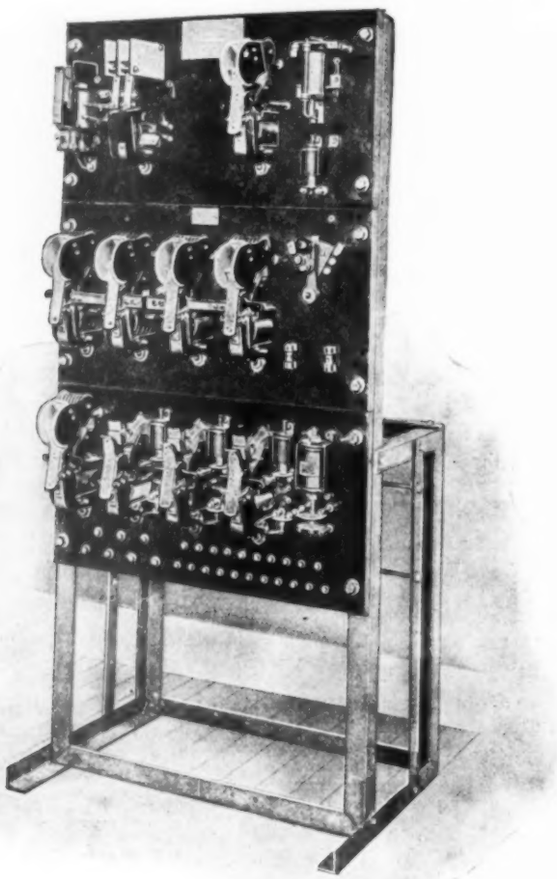


FIG. 1—CLASS 1. CONTROLLER FOR DIRECT-CURRENT ELEVATOR.

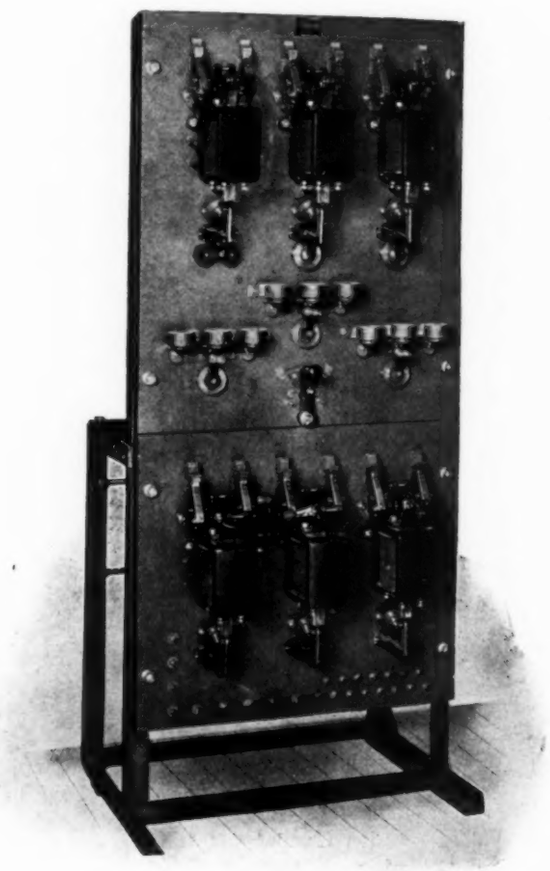


FIG. 2.—CLASS 31. CONTROLLER FOR ALTERNATING-CURRENT ELEVATOR.

In the acompanying illustrations, Fig. 1 shows a complete panel of the Class 1 controller for direct-current elevators. In this are combined the utmost refinement in control with the maximum possible safeguards for high-

speed operation. The solenoid switches mounted on the slate panel perform altogether seven functions in the control and safeguarding of the elevator.

Fig. 2 shows a controller for an alternating-current elevator designed for use with slip-ring two or three-phase induction motors. The solenoid switches govern three functions in the control and braking of the car.

FIG. 3.—CAR SWITCH.

Fig. 3 gives a good idea of the car switch used for full-magnet and semi-magnet elevator controllers. The lever is latched in the central or "off" position to prevent accidental starting of the elevator. It is released by depressing the button in the top of the handle. Should the operator remove his hand from the car switch while the elevator is in motion a centering spring throws the lever instantly to the off position and brings the car to a standstill. This insures constant watchfulness on the part of the operator and serves also as a safeguard against accident should injury or illness befall the operator while the elevator is in motion. The operating mechanism of this switch is entirely enclosed in a dustproof case, which can be easily removed when occasion requires.

One of the accessories is shown in Fig. 4. This is a rotating cam limit switch which is designed for use in connection with the traveling nut mechanism of the winding drum. This limit switch is a double-pole switch and in operating to stop the elevator disconnects both sides of the control circuit from the line. All operating parts are entirely enclosed protecting them from dirt and injury.

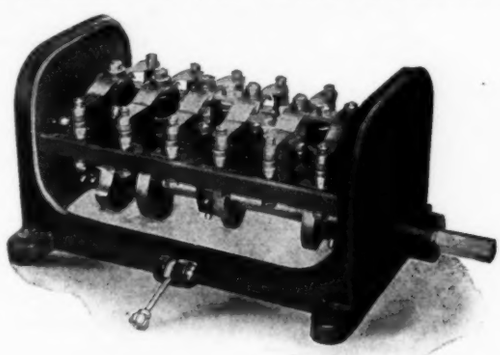


FIG. 4.—ROTATING CAM LIMIT SWITCH.

A Modern Electrically Equipped Ice Cream Factory.

The recognition which commissary authorities are now willing to accord to ice cream as an important food stuff has transferred it from the category of a mere summer delicacy to its rightful place among staple articles of food for which there is a substantial demand throughout the year. The methods of ice cream making have advanced far, in point of the sanitary and regular quality of the product, from the old days of the hand operated freezer.

An example of the modern ice cream factory employing the latest methods of production is that of E. A. Caum at Altoona, Pa. This plant has a capacity for making and storing 3,000 gallons of ice cream daily, besides producing ten tons of ice and the equivalent of thirty tons of refrigeration. This latter brine refrigerating system is used to reduce the temperature in two ice storage rooms, two milk and cream rooms, two hardening rooms, and the retail sales cabinets, besides removing heat from the ice making apparatus and the ice cream mixing and freezing machines.

The brine in the refrigerating system is cooled by the expansion of ammonia gas, previously liquified by a thirty-ton Larsen-Baker compressor. This compressor is driven through a Morse chain transmission by a fifty-horsepower, 200-volt, sixty-cycle, two-phase type CCL Westinghouse induction motor. The brine is circulated by a five-inch Aldrich triple brine pump driven by a five-horsepower Westinghouse type CCL motor.

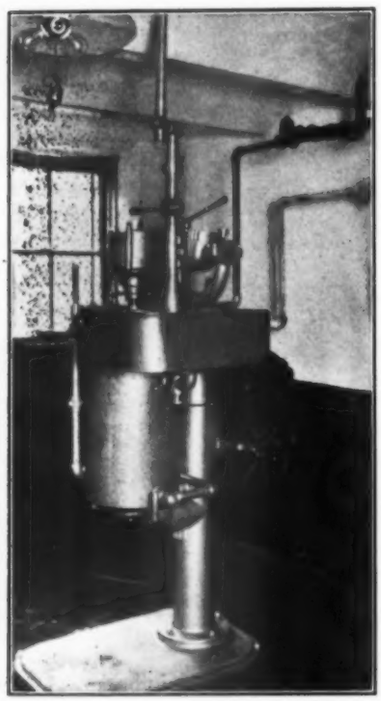
In the ice cream making department, two Miller duplex ice cream mixers, having a capacity of 150 gallons each, are installed. These are connected by German silver pipes to the refrigerating system, and are driven by two-horsepower Westinghouse type CCL motors.

Directly underneath the mixing room is the freezing department, where are located two Miller upright cream freezers, each of sixty gallons capacity per hour, and similarly chain driven by Westinghouse motors. In these machines connection to the refrigerating system takes the place of ice for the freezing operation. After being partly frozen in these machines, the cream is run out into the delivery cans of various sizes and transferred to the cooling rooms where it remains until sold.

Before refrigeration was installed, the common practice was followed by putting the ice cream as frozen into a big tub, from which it was measured into the cans and packed for shipment. This required packing the cream daily, and the ice bills alone at that time amounted to $15 or $20 a day, a figure which contrasts largely with the present total cost of running the plant since refrigeration has been operated.

A Creasy ice crusher and pasteurizing machine and butter churn and worker are also installed in the Caum factory, being driven by a three-horsepower Westinghouse type CCL motor.

Two sixteen-inch Hill deep well pumps, each capable of delivering fifty



MOTOR-DRIVEN ICE CREAM MIXER.

gallons of water per minute, are driven by five-horsepower Westinghouse CCL motors.

The power supplied to the plant is two-phase, sixty-cycle alternating current at 200 volts. All the motors are controlled from a starting panel which carries the auto-starter for the fifty-horsepower motor, the simple starting switches for throwing the other machines across the line, the lighting snap switches, and the service watt-hour meter.

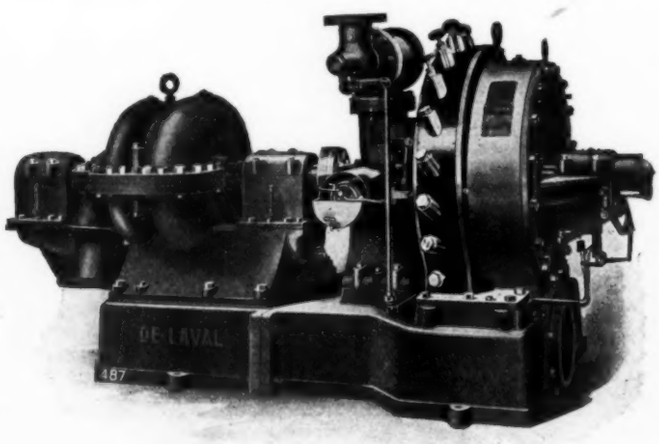
The present connected motor load aggregates seventy-two horsepower, which is operated from two and one-half to three hours per day. For this service the power bill is about $55 monthly, which covers all the costs of pumping, refrigerating, freezing and churning. As noted before, the daily ice bill alone, before refrigeration was installed, amounted sometimes to $20 per day.

The Caum factory is in all respects a model creamery plant, and the owner has expressed himself as thoroughly pleased with his adoption of new methods and motive power.

Steam Turbine-Driven Centrifugal Boiler Feed Pumps.

The centrifugal boiler feed pump, shown in the accompanying illustration, has lately been taken up by several of the large steam power plants in the United States, and while free from the defects commonly found in simple direct-acting pumps, possesses several important advantages in addition. It does not endanger the pipe line by vibration, by excessive pressure, nor by shock. The inflow of water can be regulated at the boiler without reference to the pump. A centrifugal boiler feed pump contains no valves and only two packings, of quite small diameter, to be kept tight against hot water. There is no danger of breakage of pistons, cylinder heads or packing rings through loss of suction and consequent pounding.

Simplicity of construction and accessibility for inspection are essentials for any pump that is to be installed in a boiler room and entrusted to unskilled labor. It should be possible to get at the working and wearing parts of a pump without disturbing pipe connections. As will be noted from the accompanying photograph the casing of this pump consist of two parts only, the bottom casting and the cover casting. In the bottom casting are formed the inlet and outlet passages to the piping, while both castings contain passages leading from the delivery of the first impeller to the inlet of the second, these passages being cast in the solid metal. Smoothness and exact form of the passages are secured by the use of dry sand moulds exclusively. The top or cover casting, when raised, exposes the shaft and the impeller, that is the entire interior and all working parts of the pump, and after removing the shaft-bearing caps, the impeller may be lifted out entire, so that all parts are rendered accessible by the breaking of only one packed joint, namely, that between the two halves of the main casting. The connections to the suction and discharge pipes need not be disturbed in any way. The flange of the suction opening may be seen at the end of the pump under the bearing, while the discharge opening is directed horizontally on the farther side of the pump.



CENTRIFUGAL BOILER FEED PUMP.

The bearings of a boiler feed pump destined to be operated for long periods without attention should be the best obtainable. In the present case they are all of the ring-oiled type used for electric motors and generators. They are of very ample dimensions and are supported on hollow brackets or pedestals entirely separate from the pump casting. These pedestals contain oil wells and are fitted with the usual cocks and gauge glasses.

While the impellers are in perfect hydraulic balance, one of the bearings is made of the marine thrust type in

order to take care of any end thrust that might be developed by possible clogging of the balancing passages in the impellers. On the rear side of each impeller—that is, the side opposite from the inlet—is a chamber encircled by the labyrinth rings and of the same diameter as the inlet chamber. This balancing chamber is connected to the inlet by a small hole through the impeller disc itself. It therefore contains water at the same static pressure as the water entering the impeller, and any reaction due to the entering column of water is balanced by an additional static pressure generated by the impact of this entering column of water on the small holes connecting the two chambers.

Leakage of water outboard around the shaft at the discharge end of the pump or leakage of air into the suction side of the pump are prevented by packing glands, which in addition to packing material under pressure, have a central open part to which water under pressure is introduced, effectually preventing the entrance of air. The shaft is protected by bronze sleeves extending from the outside packing up to the impeller. In case of scoring or erosion of this sleeve it can be replaced without renewing the shaft. Leakage of water around the shaft where it passes through the diaphragm separating the two stages is prevented by a long bronze-lined water-packed joint in which there is no rubbing contact.

The machine here described and illustrated is one of two shipped to the Detroit Edison Company by the De Laval Steam Turbine Company, of Trenton, N. J. The pump has shown under test at full load an efficiency of sixty per cent. Larger pumps have shown efficiencies above eighty-five per cent.

HOW THE TELEPHONE AIDS SCHOOL MANAGEMENT.

BY C. L. MULLIGAN.

The use of telephone equipment in schools is a very recent development, but it is apparent that before long the telephone as a means of interior communication among rooms and departments will be considered an important factor in the school organization. Already many architects lay out systems of interior telephones while drawing up original plans. The accompanying illustrations are views of the location of telephones in the Williamson Free School of Mechanical Trades, which may be regarded as typical of its class.

The telephones have been found of great aid to the organization of this school. They perform the service formerly left for electric bell signals, speaking tubes, messengers, and other agencies now considered obsolete.

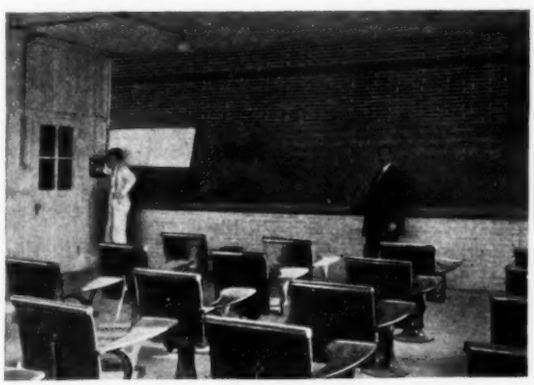
The Williamson school consists of thirty buildings extending over 230 acres of ground and located in the central part of Delaware County, Pennsylvania, about sixteen miles from Philadelphia. From this school, the benefits of which are free, boys are turned out as skilled bricklayers, carpenters, stationary engineers, machinists and pattern makers.

In carrying on its work of industrial education the Williamson school finds necessary a well developed organization. The telephones here shown are known as "Inter-phones," an automatic intercommunicating telephone system that requires no operator. The superintendent seated at his desk can put the receiver to his ear and reach instantly the engine room, the drawing room, the pattern shop, the carpenter shop, the machine shop, the bricklayers' classroom, his own house or the residences of any one of three instructors located on the school grounds.

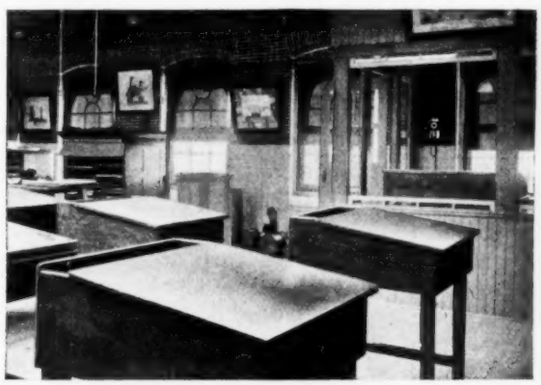
When the system was first equipped there were eleven stations. So popular did its use become, however, that it was found necessary to equip three more stations within a very short time after the original installation.

There is an unusual and interesting

INSTALLATION IN PRINCIPAL'S OFFICE.



"INTER-PHONE" IN CLASS ROOM.



DRAWING ROOM INSTALLATION.

feature in connection with the establishment of this telephone system at the Williamson school. The entire work of installation, including the running of all the cable was performed by four students of the senior class of the engineering department, under the direction of the chief engineer and a representative of the Western Electric Company, which furnished the instruments and material.

The instrument shown in the superintendent's office is one of the familiar desk sets, and at the left of the desk is seen the apparatus that makes possible connection with the outside stations. By simply pressing any one of the keys opposite the name-plate shown on this metal wall arrangement, the superintendent can get into communication with any one of his instructors in the various classrooms and shops.

The other photographs show wall "Inter-phone" sets in various parts of the school. At each one of these telephones it is necessary only to press one of a number of buttons, which in the case of the wall sets are located immediately below the transmitter.

The simplicity of these private telephones adapts them especially to school purposes, although they are being used with equal success in large business houses, residences, churches, factories, and hospitals.

An English report states that electrical generators will be installed at the Wankie coal mine in Rhodesia, South Africa, to be used in conjunction with the existing steam plant for supplying electricity for lighting and power purposes in and about the mine.

SWITCHBOARD FOR AYER MILLS, AMERICAN WOOLEN COMPANY, LAWRENCE, MASS.

By Emil Bern.

The switchboard just completed by the General Electric Company for the new Ayer Mills of the American Woolen Company, Lawrence, Mass., is claimed to be one of the largest boards ever built for alternating-current mill service.

This switchboard, as shown in Fig. 1, consists of thirty-one marble panels with sub-bases, making a total length of 67 feet 8 inches, and is designed to control one thirty-five-kilowatt steam-driven exciter, two thirty-five-kilowatt induction-motor-driven exciters, one 100 kilowatt 600-volt forty-cycle alternator, two 2,500-kilowatt 600-volt alternators, twenty-six 300-kilowatt power-feeder circuits, ten 200-kilowatt power-feeder circuits, four constant-current transformers with oil-cooled rectifiers each equipment for fifty arc lights, and twelve 600-volt, single-phase lighting circuits. A Tirrill regulator has been provided to keep constant bus voltage.

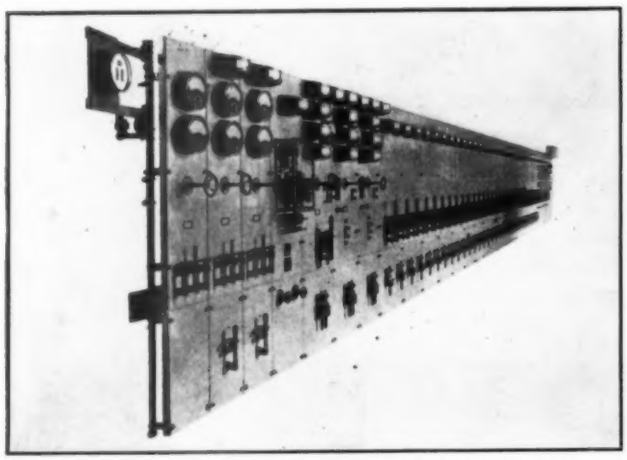


FIG. 1—VIEW OF SWITCHBOARD, AMERICAN WOOLEN COMPANY.

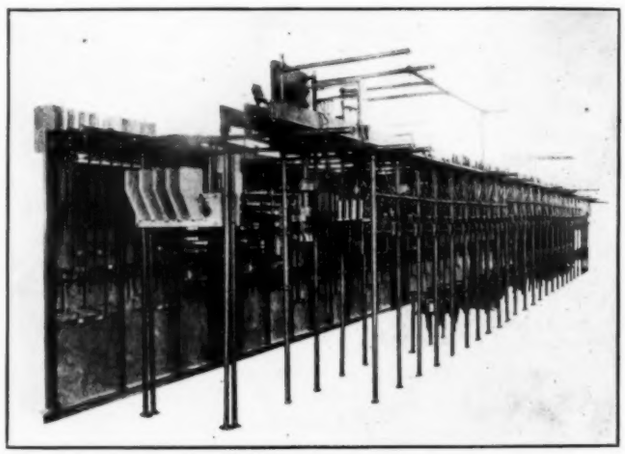


FIG. 2—REAR OF SWITCHBOARD SHOWING CONSTRUCTION AND WIRING.

The 2,500-kilowatt generators are connected to the bus bars through solenoid operated circuit-breakers of large capacity to take care of heavy overload and conditions of low-power factor. These circuit-breakers, having their control switches and overload time element relays mounted on their respective panels, are located at different points of the bus so as to give a more economical distribution and also to reduce the length of machine cables. The field switches for these machines are also solenoid operated from control switches on the board and are substantially the same design as the circuit-breakers.

The power circuits, constant current transformers and the 100-kilowatt generator have automatic oil switches of the K3 type mounted on pipe frame work below the buses and about seven feet back of the switchboard. An overload inverse time element relay for the oil switch and an indicating wattmeter are provided for each power circuit. The series transformers for these are located below the oil switches as shown in Fig. 2 in the leads between the switch terminals and the floor conduits. Asbestos barriers are being installed between the oil switches, and between the different phases of the main bus for absolute safety.

The 600-volt, single-phase lighting circuits are fed from an auxiliary bus through an indicating wattmeter and are controlled by quick-break lever switches with expulsion fuses. These switches are double-throw for transferring any circuit from one phase to another for the purpose of balancing the system.

A Live Selling Campaign for Central Stations.

The McCrum-Howell Company, manufacturers of the "Richmond" suction cleaner, is offering a live campaign to central stations for the introduction of this machine. The company puts the cleaner into any home upon receipt of one dollar, finances the actual selling work, printed matter, local advertising, etc. Central stations can get the company's plan by writing to the general offices, Park Avenue and Forty-first Street, New York, N. Y.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, FEBRUARY 11.—The first of the metal filament lamp patent infringement cases has just commenced in the High Courts. It is taken by the "Z" Electric Lamp Company against the London agents of the continental firm of Bergmann. The patent in question relates to the use of phospham for completely decarbonizing the filaments of metal filament lamps, presumably with the object of preventing blackening of the bulbs. It is alleged, and not denied, that the Bergmann company uses phospham in the manufacture of its filaments, but in the first place the claim is that the phospham is used for a different purpose, and, secondly, that there is no subject matter for patent in the use of phospham. They also cite four patents, two British and two German, as anticipations of the "Z" patent. An interesting feature of the case is the discussion as to what phospham really is. Both sides differ very considerably and experiments carried out upon substances called phospham supplied by different makers have produced almost totally different results. The theory of the Bergmann company is that the internal blackening of metal filament lamps is not due to the carbon particles remaining in the tungsten filament, as is generally supposed, but is due to tungsten deposit, and that they use phospham to prevent the taking place. They claim that their filaments are more free from carbon without any phospham treatment than are "Z" filaments after the phospham treatment, assuming that this latter does decompose the carbon and that, therefore, there is no infringement. The claim is also made against the validity of the "Z" patent that the reactions which are said to take place by the use of phospham do not, in practice, take place, and that in consequence, the patent is misleading.

An interesting and important experiment has been sanctioned by the London County Council, viz., the running of trailer cars to relieve the "rush" in the evening. The sanction of both the Board of Trade and the Commissioner of Police has had to be obtained, and arrangements are being made for two single-deck cars being run together for the purpose.

In their desire to reach the smaller class of consumer, the heads of electricity undertakings are making great efforts to evolve some system of charging, which shall be at the same time both simple and reasonable. So far, however, nothing startlingly new has been hit upon, but a number of municipalities, including Liverpool, are giving a trial to the system of supplying an unlimited amount of energy upon the basis of an annual payment according to the rateable value of the property supplied. The figure taken is about twelve per cent. In Norwich, where the system was originated, it has been successful for middle class residential property of $150 per annum and upwards.

The remarkable results obtained since the introduction of single-phase traction on the London, Brighton and South Coast Railway Company's line in London were referred to in detail at the half-yearly meeting this week. Compared with the corresponding period of last year, there has been an increase of fifty-five per cent in the number of passengers carried, and practically the whole of the traffic abstracted by the tramways, has been recovered.

The Telewriter Syndicate has just been granted a twenty-one years' license by the Postmaster General for the establishment of telewriter exchanges.

An official return states that there are now 2,360 miles of electric tramways in Great Britain, in the hands of 298 undertakings, of which 176 are municipalities and 122 companies. Since 1878 the route length of lines has increased from 269 miles to 2,536 (of which 2,360 are worked electrically), the capital expenditure from $21,036,750 to $355,116,195; the number of passengers carried from 146 millions to 2,660 millions and the net receipts from $1,154,780 to $22,978,895. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, FEBRUARY 10.—The new station of San Paolo in the suburbs of Rome, has been recently finished, and it is designed to give an additional supply of current for the city. It works in parallel with the hydraulic plans of Tivoli and Subiaco and the steam plant of Cerchi, these being under the control of the Anglo-Roman Company. Seeing that the use of current has been rapidly increasing of late, the company decided to build the new plant at San Paolo, and it now has an output of 6,000 kilowatts. The machines are installed by the Thomson-Houston Company, including two main groups, these being Curtis turbines and alternators of 3,000 kilowatts, but the dynamo room is laid out so as to receive double this number of machines in the future. The boiler room contains twelve water-tube boilers and the furnaces have automatic stokers. Eight thousand five hundred volts are furnished by the alternators, these being of the three-phase type, and the outside lines are fed at this voltage.

Among the new electric light and power enterprise in France I note the large station which is to be erected at Servieres. It will furnish current over an extensive area. At Mouxy, in the Rhone region, the municipal council is examining a project for electric lighting. Nice is soon to have a motor-driven cable incline installed. In the Var district there is a project for an electric railroad from Salernes to Aups. The town of Vannes is to carry out an electric lighting system in the near future.

A gas-engine plant has been erected by the Orleans Railroad Company at Tours, for the lighting of the stations of Tours and St. Pierre, as well as the extensive yards and shops, which are here located. Producer gas is employed, using a set of eight Fichet-Heurty producers of 300 horsepower size. Four gas engines are erected, these being made after the Augsburg-Nuremburg type by the French firm of Garnier-Beaulieu, having an output of 600 horsepower each. To each engine is coupled a 560-volt direct-current generator, built by the French Westinghouse company. There is operated a storage battery in parallel with the generator.

The municipality of Parma, Italy, is engaged upon an extensive propect for electric tramways and suburban railroads, which is to include a number of separate lines. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, ONT., FEBRUARY 26.—The Ontario hydroelectric commission has completed its arrangements for supplying power to the city of Port Arthur, Ont. The whole cost will only be $50,447, or nearly $15,000 below the estimate.

Capitalists of Niagara Falls and Welland, Ont., are interested in a company which has just been formed to construct an electric trolley line from Queenstown to Niagara-on-the-Lake. The company has been capitalized at $100,000, and the line will be built during the coming summer.

The annual report of the Niagara Falls Power Company and the Canadian Niagara Power Company, for the year ended December 31, 1909, shows the gross earnings to have been $1,952,348, and the net, $1,520,051, leaving a surplus of $454,494. This is equal to 10.82 per cent on the $4,200,000 outstanding capital stock, and is an increase of $297,203 over the surplus of last year.

The gross earnings, during the past year, of the various subsidiary companies of the Dominion Power and Transmission Company, of Hamilton, Ont., amounted to $1,691,596, and the operating expenses to $963,949. It was announced at the annual meeting that the earnings of the traction companies showed an increase of $87,120, but it was decided not to pay a dividend this year, considerable money having been spent on street railway improvements.

A big transportation project, involving the construction of an underground and elevated railway, is announced by the notice of application for a charter from the local government. The company is the "Montreal Underground and Elevated Railway Company." It is to be capitalized at $20,000,000. It seeks for power to build and operate by electricity, or other motive power, underground and elevated railways through the city and island of Montreal; to develop waterpowers and build transmission lines; to construct, acquire and operate telegraph and telephone lines, and all other lines for the transmission and distribution of electricity for power, lighting and heating, and of compressed air or other energy and to transmit and dispose of such power and energy, etc.

Ontario is to have a provincial telephone act. This measure will supplement the action of the Dominion Parliament. Under the co-operative acts, the public will have control of the entire telephone service. The act will place the control of all independent companies and concerns in the hands of the Ontario Railway and Municipal Board, in similar terms to the Dominion measure which commits the jurisdiction of the trunk lines to the federal railway commission. The rural telephone enterprises have grown to remarkable proportions in Ontario, and the primary object is to secure co-operation among rural companies in providing an efficient service to the public.

At the annual meeting, held in Montreal, of the Bell Telephone Company of Canada, the financial statement showed gross receipts of $4,949,197, and a net revenue of $1,468,889. Dividends of $1,000,000 were paid, and a surplus of $468,889 on the year's operations. The report also shows that 13,671 new subscribers have been added during the year, the total number of sets of instruments now earning rental being 114,735. The company now owns and operates 476 exchanges and 1,247 agencies. There were added, during the year, to the long-distance system, 2,966 miles of wire, and the long lines now owned and operated by the company comprise 48,969 miles of

wire on 8,026 miles of poles. The company has made arrangements for exchange of business with about 330 independent companies, serving over 20,000 subscribers. W.

MEXICO.

(Special Correspondence.)

MEXICO CITY, MEX., FEBRUARY 28.—The Compania Minera de Penoles and the Compania Minera de San Juan are waging a lively competition for the furnishing electric lights for Mapimi, State of Durango. Both companies have electric power and lighting plants, that were installed primarily for the purpose of supplying their mines and mills with those commodities. Mapimi is a great mining camp and the Compania Minera de Penoles showed its public-spiritedness by stringing lights along one of the principal streets. Immediately the Compania Minera de San Juan branched out into the public service and placed its lights upon other streets. It is now contracting for furnishing lights and power to private consumers.

It is reported that owing to the fact that the large smelter at Auguascalientes has refused to contract with the Chapala Hydro-Electric and Irrigation Company of Guadalajara for the use of electric power that company will not build its transmission line to that city. The smelter is one of the largest industrial concerns in Mexico and it was expected that it would use a large amount of power.

The Tajo Mining Company will install a hydroelectric plant at its mines near San Sebastian, State of Jalisco. It will use the water that flows from one of its long tunnels for the purpose of generating the initial power.

The annual report of the Guanajuato Reduction and Mines Company that was recently made shows that it derived the sum of $708,000 last year from the sale of power in the Guanajuato district. This company has its headquarters at Colorado Springs, Colo.

Juan Welsby Gellin and Francisco Serrano Gallardo, of San Francisco, have applied to the government for a concession to establish a factory in Mexico City for the manufacture of telephone and telegraph wires and cables. They bind themselves to invest not less than $200,000 in the enterprise. Fernando Liceaga, of Mexico City, will install a hydroelectric plant on the Ahuacatlan River in the territory of Tepic. He has applied to the federal government for permission to use the water of that river for the purpose. D.

IMPORTANT DEVELOPMENTS.

WORK STARTED AT HIGH FALLS, N. Y.—Preliminary work has started on the plant at High Falls, and the plant will be constructed during the spring. A fall of fifty feet with a possible seventy-two from the top of the dam to the power house will be secured and the large volume of water from the drainage of 350 square miles of territory will make it possible to develop 4,000 horsepower. Machinery will be bought at once for 1,000 horsepower and more will be installed as needed. The company recently purchased the water rights of Samuel Coykendall at the falls so it now controls all the power there. Should New York City take the Rondout Stream and do away with the power at Honk Falls the company will develop water rights on the Beerkill Stream in the Greenfield section where it made large purchases of land two years ago.

POWER FROM THE AU TRAIN RIVER.—The Cleveland Cliffs Iron Company has begun the construction of a dam at the head of the falls on Au Train River, to develop electric power for the operation of the paper mill at Munising, Mich. The dam will be twenty feet high, 140 feet in length and twenty-four feet thick at the base. It is planned to begin work on the power plant as early in the spring as the weather will permit. This plant will be located a quarter of a mile below the dam. From the power house, the current will be transmitted to the Munising Paper Mill over a pole line, thirteen miles in length, which will be built along the line of the Munising Railway. Au Train will be the second of the streams in this part of the upper peninsula to be harnessed for commercial or industrial purposes, the other being Dead River, a small part of which is utilized for the Marquette City Light and Power Plant.

LIGHTING AND POWER.

(Special Correspondence.)

MAZEPPA, MINN.—The Zumbro Power Company will erect a modern hydroelectric plant, with a forty-foot dam, and install turbines and generators on the Zumbro River in the towns of Mazeppa and Zumbro. C.

POCAHONTAS, IOWA.—Oscar Claussen, engineer, St. Paul, Minn., will prepare plans for the installation of electric lights. C.

ORTONVILLE, MINN.—The city clerk will advertise for bids for the installaton of an additional engine and dynamo at an estimated cost of $3,000. C.

BROKEN BOW, NEB.—A franchise has been granted to Edgar P. Steen and Chas. C. Gibson, of Cripple Creek, Colo., for the installation of an electric light system. C.

GRAND FORKS, N. D.—Bonds for $25,000 for the installation of an electric light plant have been voted. C.

LIDGERWOOD, N. D.—W. R. Nevius has applied to the council for a franchise for the installation of an electric light system. C.

GILBERT, MINN.—Bonds for $1,500 for improvements in the lighting system have been voted. C.

MARBLE, MINN.—The town will be lighted by electricity, the power to be furnished by the Oliver Iron Mining Company. C.

HOMER CITY, PA.—The Homer City Electric Company has been incorporated with a capital of $5,000.

ADAIRSVILLE, GA.—This city contemplates installation of electric lights. Communications should be addressed to Henry M. Veach, mayor. B.

BIRMINGHAM, ALA.—The city of Birmingham will improve the electric lighting plant of North Birmingham, now a part of the city of Birmingham. B.

BELLINGHAM, WASH.—Work on the Skagit Power Plant is to begin not later than March 3. The plant will cost about $6,000,000 and have a capacity of 100,000 horsepower. A.

EVANSVILLE, IND.—The Evansville Gas and Electric Light Company is asking the board of public works for a franchise to build and operate a new lighting and heating plant. S.

LANCASTER, S. C.—The town is completing the installation of a modern street lighting system, the current to be derived from the transmission lines of the Southern Power Company. L.

ASHLAND, O.—Construction work on the new plant of the Ashland Gas and Electric Light Company will commence in a short time. S. N. Blake, of Providence, R. I., is general manager of the company.

BREVARD, N. C.—The Brevard Light and Power Company has been chartered with $25,000 capital stock by J. W. Chapman and associates, taking over the properties of the local lighting and power company. L.

WASHBURN, WIS.—The substation here of the Ashland Lighting Company has been almost completed and power will soon be received here from the company's dam at Ashland Junction on the White River. M.

VANCOUVER, WASH.—The new electric light plant at Yacolt, Wash., was turned on a short time ago. The streets are lighted with tungsten lamps of 200-candlepower and the equipment is capable of furnishing 3,000 lamps.

SCOTTSVILLE, VA.—The company awarded the electric light, water and telephone franchise for Scottsville will shortly begin the work of putting in lights in the town. The power will be obtained from Hardware River, several miles north of this place.

BUCYRUS, O.—The gas plant which has been in operation for the past fifty-two years was recently shut down, and electric light is now furnished by the Bucyrus Gas and Electric Light Company. The gas plant is to be held as a reserve means of furnishing light.

BAY MINETTE, ALA.—The Bay Minette Land Company, of which H. P. Ewing is president, will erect a $325,000 light plant, if the city will guarantee $300 per month to the company patronage. At a recent council meeting the matter was taken under consideration.

HOUSTON, TEXAS.—The board of directors of the Houston Electric Company has approved proposed expenditures to the amount of $700,000 to be made during the present year for extensions and improvement of track and the purchase of additional equipment.

HOLDENVILLE, OKLA.—The Holdenville Ice and Electric Company of this city, has been incorporated with a capital of $50,000. The directors are C. W. Dawley, of McAlester; H. T. Douglas, of Shawnee; L. P. Sammons, James A. Chapman, Harry H. Rogers and H. M. Dunn, of Holdenville.

SAN FRANCISCO, CAL.—The officers of the Pacific Lighting Corporation have been re-elected as follows: C. O. G. Miller, president; George H. Collins, vice-president, and Horace H. Miller, secretary. The annual report shows that the gross sales are $2,892,000, an increase of $346,000 over the year 1908. A.

ANTWERP, N. Y.—The Antwerp Light and Power Company of the village of Antwerp, N. Y., has been incorporated by the secretary of state. The capital stock is $45,000, consisting of shares of $100 each. The directors for the first year are: Joseph A. Baumert, H. Maude Baumert and Peter Campbell, of Antwerp.

NORWICH, CONN.—The Uncas Power Company, which has erected a big electric power plant on the Shetucket River near Scotland Station, has begun supplying electricity to the Norwich municipal electric plant for lighting and power purposes. The starting of the Uncas plant was delayed by scarcity of water.

WILSON, N. Y.—The village board has just let the contract of lighting the city by electricity to the Bryant and Conaut Company, of Buffalo, which agrees to light the village for $1,000 a year, furnishing for this amount fifty-five incandescent and three arc lights. There will be also 100 families who will light their homes with electricity.

APPLETON, WIS.—The new power plant which the Kimberley-Clark Company is erecting at the old Vulcan mill is being rapidly completed. The powerhouse is to be equipped with four waterwheels of 1,800 horsepower capacity. A head of fifteen feet will be obtained. It is hoped to have part of the plant in operation in a few weeks. M.

LOUISVILLE, KY.—A certificate of increase of capital was

filed by the Louisville Lighting Company in the County Clerk's office this afternoon. The increase is $1,150,000 in preferred stock of $100 a share. The certificate is signed by F. M. Sackett, the president, and W. H. Edinger, John Stites, James B. Brown and Matt L. Akers, directors.

SASKATOON, SASK.—The city has let the contract for supplying light meters to the Canadian General Electric Company and the Packard Electric Company, of Toronto; for copper wire to the Canadian Electric Company; for transformers to the Packard Electric Company, and for electrical supplies to the Northern Electric and Manufacturing Company, Toronto. C.

SANTA FE, N. M.—The Gila River Power Company has filed incorporation papers in the office of Territorial Secretary Nathan Jaffa. The capitalization is $6,000,000. The headquarters are Silver City, Grant County, and the incorporators and directors are Thomas Lyons, of Gila, William D. Murray, of Silver City, and John R. Bartlett, of 2 Wall Street, New York city.

EASLEY, S. C.—President J. M. Geer, of the Easley Mills, has signed a contract with the Southern Power Company for 250 horsepower of electricity, or as much more as he may desire with which to supplement the power used to run the Easley Cotton Mills and also to light the mill village. The Southern Power Company will go to work at once extending the line from Greenville to Easley.

WINCHESTER, VA.—The Winchester and Washington City Railway Company has awarded contracts for the erection and equipment of an auxiliary steam electrical plant, to be operated in connection with the waterpower plant at Millville, W. Va. The new plant will cost $100,000 and the capacity of both will be about 5,000 horsepower. The principal contracts, amounting to $50,000, went to the Westinghouse company.

GREENVILLE, S. C.—The contract for the construction of the power development on the Etowah River, near Creighton, Ga., for the Blue Ridge Power Company, has been secured by Frank D. Gilbreth, Incorporated, 60 Broadway, New York. This work will include the construction of a Ransom Hollow dam forty-two feet high and 600 feet long, and a reinforced concrete powerhouse sufficient for 4,000 horsepower to be installed.

BOULDER, COL.—Superintendent Taylor of the Central Colorado Power Company is installing the big generators at the powerhouse in Middle Boulder canon. The initial installation will be 10,000 kilowatts, the water coming to the wheels with a head of 1,860 feet and flowing through concrete pipes over twelve miles from the Nederland reservoir to the Kosler forebay, from which it is conducted in a steel pipe to the powerhouse.

ALBUQUERQUE, N. M.—Ernest H. Fischer, of this place, has been granted permission by Vernon L. Sullivan, territorial engineer, to use 150 second-feet of water of the Pecos and Mora Rivers at points about twenty miles from Santa Fe, for the purpose of developing 5,000 horsepower. Mr. Fischer will install large hydroelectric plants and build transmission lines to Aubuquerque, Santa Fe, Las Vegas and other places within a radius of 150 miles.

WILLIAMSON, N. Y.—The Williamson Light and Ice Company is busily at work enlarging its plant preparatory to furnishing electrical power for the Williamson Coal and Coke Company, and for any other company within a radius of several miles of the city, which may desire its service. About $15,000 will be spent in the work of enlargement and when completed this will be the most complete light plant in this section of West Virginia.

NEW CASTLE, PA.—Work has been started at the plant of the Universal Pottery Company in the Seventh Ward, on the installation of an electric light plant to supply light for the entire pottery. A dynamo and steam engine are being placed in position and a complete light plant will be constructed. It is expected to place about 150 lights on the circuit at the start and if this proves insufficient to supply the needs at the plant, more will be added.

TACOMA, WASH.—The Seattle-Tacoma Power Company announces it has acquired land for extensive additions to its power plant at Snoqualmie Falls. A twelve-foot tunnel a quarter of a mile long will be bored through solid rock. An expenditure of half a million dollars is contempated with an increase of 30,000 horsepower. The first instalation of machinery will have a capacity of 10,000 horsepower, which, it is expected, will be ready for operation next fall.

CAPE MAY, N. J.—The entire capital stock of the Cape May Light and Power Company, of this city, has been purchased by a company of which Nelson Z. Graves, of Philadelphia, is the president. The price paid for the stock is said to have been $165,000. Besides Nelson Z. Graves, the purchasing company comprises Virginius F. Graves, treasurer; Edward H. Heilman, secretary; Nelson Z. Graves, Virginius F. Graves, Peter Shields, Henry W. Hayden and C. Earle Miller, directors.

PITTSBURG, PA.—A contract has been placed with the Allegheny County Light Company by the Carnegie Steel Company for its supply of electric power for the steel company's new warehouse at Twelfth and Pike Streets. The contract provides for 650 horsepower to operate light electric cranes, numerous shears, punches, lathes, drills, cold saws and complete machine shop. It also includes forty flaming arc lamps and other illumination. The steel company's new warehouse is being erected to supply the jobbers' trade.

SEATTLE, WASH.—The Pacific Coast Power Company will expend, within the next two years, $2,500,000 in the construction of a hydroelectric power plant at Lake Tapps, Pierce County, and in the development and distribution among the Puget Sound cities of 25,000 electric horsepower.

MONTGOMERY, ALA.—The Montgomery Light and Water Power Company, of which Robert J. Chambers is general-manager, has shown its appreciation of the mayor's efforts for a city beautiful by painting and enameling the arc lamps and reflectors in the city. The lamps are also to be lined up; other things are being done to improve the appearance of the system. Mr. Chambers showed further his interest in the welfare of the city by securing the annual convention of the Southern Gas Association, which meets there in April.

AUSTIN, TEXAS.—The several propositions that have been submitted recently to the city council for the rebuilding of the great dam across the Colorado River at Austin and the installation of a hydroelectric plant are still under consideration by that body. It is stated that the proposition of M. Dumont is being looked upon with considerable favor. Mr. Dumont's brother in Paris, France, is endeavoring to interest men there in the financing of the enterprise and if he succeeds it is expected that the city council will take definite action upon the proposition.

HAYWARD, CAL.—The Board of Trustees has passed a resolution granting a franchise to the United Power Company for stringing wires to supply light and power to the city. The United Power Company is an associate of the People's Electric Light and Power Company and is warring against the Oakland Gas, Light and Heat Company and the Suburban Power and Light Company. The two latter companies practically control the heating and lighting situation in Alameda County, and a fight for this control may result in cheaper rates for the consumers.

RALEIGH, N. C.—The Carolina Light and Power Company has planned to expend the sum of $175,000 in improvements on its Raleigh lines and equipment, the company having contracted for the following items: One 2,500-kilowatt turbine and generator; two 4,000-horsepower boilers; Murphy automatic stokers, and coal and ash-handling device. The powerhouse will also be considerably enlarged and altered, making room for the new and additional equipment. The company has been very successful in its operations in Raleigh since its organization. L.

ELBERTON, GA.—The Interstate Power Company, which has been engaged in recording a $5,000,000 mortgage to the Carnegie Trust Company, of New York, in a number of South Carolina and Georgia counties, will have headquarters in this city, it is stated. The company's plans are understood to be the taking over of electrical properties and waterpower sites in Georgia and South Carolina, confined largely to the Savannah and Broad Rivers in the two states named. The company, it is expected, will consummate a number of important electrical developments and several power plants. L.

WICHITA, KAN.—The Kansas Gas and Electric Company, which is a merger of the United Gas Company, the Edison Light and Power Company, of Wichita, and the Home Light, Heat and Power Company, of Pittsburg, Kan., has recently been chartered under the laws of Kansas. This charter gives the right to accumulate similar properties as they may see fit throughout Southern Kansas. A semi-official statement as to the officers of the merger corporation is given out as follows: H. P. Wright, Kansas City, president; L. O. Ripley, New York and Wichita, vice-president; F. G. Sykes, New York, vice-president; N. H. Arning, New York, treasurer. The secretary is yet to be named.

AMERICAN FORK, U.—The power plant under construction in Alpine Canyon, by the Utah County Light and Power Company, is fast nearing completion. The large steel pressure pipe has been laid, the wood flume leading to the steel pipe has practically all been completed, and the construction of the brick and steel building is being rushed. The machinery which will be used in this plant has been received and now awaits transportation to the site of the plant. It is expected that some difficulty will be experienced in getting the eight-ton armature to the site of the plant. This plant will be the largest which the local company will have in operation, and will be in many ways one of the best plants in operation in this state.

GOUVERNEUR, N. Y.—C. D. Hodge & Company, of Watertown, to whom was awarded a contract by the Oswegatchie Light and Power Company, of this village, for the development of a 1,400 horsepower waterpower on the Oswegatchie, one and one-half mile from Gouverneur, commenced operations recently, and the work will be rushed to completion with all possible haste. The powerhouse, which will be constructed on this site, will be fifty feet in length and thirty feet wide. The plans call for the construction of a concrete and steel frame seventy feet in length and forty feet wide. The contract further calls for its completion on July 1, and includes the excavation of 8,000 cubic yards of dirt. The power will be used in conjunction with other electrical development of this company, which lights this village and pumps its water.

ELECTRIC RAILWAYS.

(Special Correspondence.)

SALTILLO, MEXICO.—Work will soon commence on the installation of an electric street-car line here. A.

NUEVO LAREDO, TEXAS.—An electric street-car line, under the management of Amado Gonzales, will be in operation here before October of this year. A.

SAN FRANCISCO, CAL.—The Petaluma and Santa Rosa Railroad Company reports an increase of about $15,000 in receipts, compared with the previous year.

ALBUQUERQUE, N. M.—The Citizens' Traction and Power Company has let a contract to J. H. Barrett for the construction of the Highland Street electric line.

SAN RAFAEL, CAL.—Construction work of the Highland Pacific Electric Railroad, which is to go by way of Santa Rosa to San Francisco Bay has been started. McNear's Point will probably be the bay terminal.

BOWLING GREEN, OHIO.—Within a few weeks cars will be running between Woodville and Tontogany, O., over the new extension of the Lake Erie, Bowling Green and Napoleon line. The road opens up a rich farming section. H.

EAU CLAIRE, WIS.—The Chippewa Valley Railway, Light and Power Company has increased its capital stock to $2,000,000 in order to build its proposed dam and powerhouse on Red Cedar River near Menomonie and make other improvements. M.

WARSAW, IND.—The Winona Interurban Company, which has just completed a link between this city and Peru, making trolley travel possible between Louisville, Ky., and Chicago, Ills., is advertising for bids for the construction of a branch line fourteen miles in length between Bremen and Milford. S.

CEDAR RAPIDS, IOWA.—The Cedar Rapids & Marion City Railway Company is increasing its power equipment and has recently palced an order with Allis-Chalmers Company for a complete railway generating unit consisting of a heavy duty cross-compound engine, direct connected to an 800 kilowatt 600-volt generator.

PORTLAND, IND.—The city council has granted a franchise asked by the Ft. Wayne and Springfield Traction Company for an extension of the line from Decatur to Portland. The officials of the road announce that the contract for the construction of the extension will be awarded in time for work to be begun in early spring. S.

GASTONIA, N. C.—The Isothermal Traction Company has entered the field of interurban electrical development, and has been chartered by the secretary of state, the purposes set forth in the charter being the building of an electric railway to connect Gastonia and Rutherfordton, the line to be not greater than fifty miles in length. The capital stock is $100,000. L.

ROCHESTER, IND.—The Wabash-Rochester Electric Railroad Company has paid the tax on its right-of-way between the two cities and has given assurances that the line will be constructed during the present year. The farmers are greatly interested in the line and will aid in its construction. Fletcher Stone, J. H. Grindle, A. A. Gast and others are interesed. S.

JEFFERSONVILLE, IND.—The American Car and Foundry Company, of this city, is building five interurban cars for the Louisville and Eastern Traction Company at a cost of $11,000 each. These cars are said to be the largest interurban cars ever built, being sixty-two feet long and fitted with four seventy-five horsepower motors each. They are broad gauge and handsomely equipped. S.

ST. MARYS, O.—A charter was this week granted to the Minster & Loramie Railway Company. The company will construct an electric line connecting at Minster with the southern terminal of the Western Ohio. Its capital stock is $100,000. The incorporators are: J. H. Koenig, F. D. Carpenter, E. C. Riddle, E. L. Herr and C. C. Collins. Work will be started as soon as weather will admit. The line taps some of the best farming territory in Ohio. H.

SOUTH NORWALK, CONN.—The Shore Line electric railway, from Stony Creek through the towns fronting on the Sound to Saybrook, thence up to Essex and Ivoryton, a distance of about thirty miles, will be opened for traffic early in the spring, according to the statement made by one of the officers of the company. Practically all of the roadway has been completed, except for a short distance in the town of Guilford.

ROCHESTER, N. Y.—The Rochester Railway and Light Company is considering the desirability of installing gas engines as a supplementary source of power, and within a short time the means to be employed in increasing the power output of the company by some 5,000 horsepower will have been selected. Should gas engines be employed, it is expected that they will be installed at No. 3 Station, on Brown's Race, near Furnace Street.

MADISON, WIS.—The Southern Wisconsin Railway Company has filed its annual report with the state railroad commission. The earnings of the company for 1909 were $159,778.82, and the operating expenses were $89,271.09. The company has increased the total mileage of its street railway system here from 10.7 miles in 1907 to 13.5 miles in 1909. The payroll for 1909 amounted to $47,060. The company now has seventy-seven employes in its service. M.

DEFIANCE, O.—Announcement is made that the Northwestern Ohio Electric Railway and the Cincinnati, Dayton & Ft. Wayne Electric Railway, both of which were delayed by the recent business depression will now be pushed to completion. The former is planned to connect Defiance and Montpelier, while the latter will connect Cincinnati and Ft. Wayne. The promotors state that both lines have been practically financed and that work will start in the early spring. H.

NEW BREMEN, O.—The Minster and Loramie Railway Company, with a capital stock of $100,000, has been granted a charter by the secretary of state. The incorporators are F. D. Carpenter, E. L. Herr, E. C. Riddle, C. C. Collins and John H. Koenig. The intention of the company is to build an electric railway from Minster to Loramie, a distance of three miles, to connect with the Western Ohio at Minster and practically form an extension of the latter road from that place.

GALVESTON, TEXAS.—It is announced by Mark Lowd, southwestern manager of the Stone & Webster engineering syndicate of Boston, Mass., that the construction of the Galveston-Houston Electric Interurban railway will be started some time next month and that it will be finished and ready for operation by the time the great concrete causeway across Galveston Bay is completed. The line will be about fifty-one miles long. Mr. Lowd will be superintendent of construction of the road.

MADISON, WIS.—The Wisconsin Railroad Commission has ruled that it has jurisdiction in the case of the city of Neenah versus the Wisconsin Traction, Light, Heat and Power Company, and the Wisconsin Electric Railway Company. Neenah asked the commission that a joint passenger rate be given by the two companies within the corporate limits, and the former company questioned the jurisdiction of the railroad commission in the case. The hearing has been set for March 15. M.

APPLETON, WIS.—The Wisconsin Traction, Light, Heat and Power Company is increasing the capacity of its power plant here by the installation of two low-pressure steam turbo-generators. These will be furnished by Allis-Chalmers Company and will each have a capacity of 1,250 kilowatts, developing sixty-cycle, three-phase, 2,300-volt current. Steam will be received from the existing compound engines at seventeen pounds absolute and the turbines will exhaust into a twenty-eight-inch vacuum.

MEXICO, MO.—Construction has been started on the new Mexico, Santa Fe & Perry Electric Railroad by J. J. Burns, a contractor. The powerhouse has been built on Salt River north of this city. The work of putting in the machinery is under way. When the road is completed Hannibal can be reached from Mexico in a direct line, as the Hannibal Short Line runs to Perry. The road is to be built to Hereford, about seventeen miles northeast of Columbia, and then an extension made to the latter city.

SOUTH BEND, IND.—The Indiana Northern Railway Company and the Michigan Southern Traction Company have effected a consolidation and the proposed purchase of the latter declared off. New offices will be selected in a short time and a schedule for operation adopted. The consolidation means the construction of two or more branch connecting lines so as to accommodate a large traffic to all the summer resorts in Indiana and Michiian. S. T. Murdock and J. Mac. M. Smith negotiated the consolidation. S.

GREENVILLE, S. C.—A committee of one hundred citizens met at Fountain Inn, S. C., a few days ago to formulate plans for urging upon the stockholders of the Greenville, Spartanburg and Anderson Electric Railway Company the desirability of building a branch line to Clinton, forty-five miles in length. Committees were appointed to secure right-of-way which, it is propsed to offer the electric railway company, while another committtee has been favorably received by President Thackston, of the electric railway. L.

SPRINGFIELD, ILL.—Companies for the construction of connecting links in the McKinley traction system have been incorporated. One of these is known as the Peoria Southern Railway Company, covering a line from Peoria to Pekin. The other is the Peoria Northern Railway Company, and the line is to extend from Peoria to Peru, Bureau County. In each case the capital stock is $2,500 and the incorporators are H. E. Chubbuck, H. J. Vance, H. C. Dillon and W. J. Schelpohl, of Peoria, and W. H. Carnajan, of Champaign.

PITTSFIELD, MASS.—The terms of sale under which the Pittsfield Street Railway Company's stock is to go to the New England Investment and Securities Company have been made public. When the deal is closed all stockholders are to receive $275 per share in cash. The Dolan interests, which are in control, will receive a bonus of $75,000. These interests will probably receive a profit of $500,000. The New England Investment and Securities Company is a holding company of the New York, New Haven & Hartford Railway Company.

LAFAYETTE, IND.—Samuel T. Murdock, a traction magnate of this city, has made formal official announcement of the purchase and taking over of the Southern Michigan Electric Road, running from South Bend, Ind., through Niles to St. Joseph, Mich., a distance of thirty-six miles. Mr. Murdock stated that their plans

were for an immediate reorganization of the company and the construction of branch lines from Niles to Buchanan and from Niles to Dowagiac, Mich., and ultimately to Kalamazoo to connect with the Michigan United lines, affording trolley connections to Detroit. S.

MADISON, WIS.—The survey for the proposed interurban railroad of the Chicago and Wisconsin Valley Railroad Company to run between Janesville and Merril, passing through Madison, Friendship and other county seats, has been completed between Stevens Point and a point within a short distance of Madison. It is stated that actual construction work is to start in the spring. President Russell states that the first construction will be beween Madison and Portage. It is said that the Western Indiana Construction Company has charge of the construction of the proposed line. M.

BUFFALO, N. Y.—According to a recent statement made by General Manager Seixas of the Niagara, St. Catharines & Toronto Railway, it is probable that the new trolley line from Buffalo to Port Colborne, Ont., will be built as far as Crystal Beach and cars running early this summer. The line is to start at the International Bridge and go up the river past the ferry to the lake. It will follow the lake shore all the way, passing near Crystal Beach, Point Abino, Sherkston, and the numerous summer settlements along the shore, affording a convenient way for those who summer there to get to and from the city.

LIMA, O.—Because of the doubling of the capacity of the Ohio Steel Casting Company's plant, and the possible building of still additional facilities the Lima street railway lines will be extended in a loop for more than two miles encircling the new industrial section of the city to the southward. The new interurban station of the Schoepf Ohio Electric, is now in course of construction at an estimated cost of $75,000, and the Ohio Electric is considering the advisability of building a line eastward to connect with other tractions north and east at Bucyrus. The Defiance line will be put on a bi-hourly schedule in the near future.

BIRMINGHAM, ALA.—The Alabama Aerial Tramway Company has been organized with $200,000 capital stock. J. D. Kirkpatrick is president, J. K. Barton, vice-president and general manager, and C. D. Wittichen, secretary. The directors are Mr. Kirkpatrick, Mr. Barton, Guy R. Johnson and George H. Clarke, all of Atlanta, and J. M. Vebabke, of Pittsburg, Pa. The company will supply short-distance transportation by means of an aerial cable. It is claimed that by reason of loop-sections the tension is equalized, and the cables kept taut at all times. The company will engage actively in the manufacture and sale of aerial railway supplies. B.

GREENVILLE, S. C.—The Greenville, Spartanburg and Anderson Railway has organized with the following directors: J. B. Lee, Aug. W. Smith, Spartanburg; E. A. Smith, L. W. Parker, H. J. Haynsworth and W. J. Thackston, Greenville; J. R. Vandiver, D. P. McBrayer and J. D. Hammett, Anderson; and J. P. Gossett, Williamston, S. C. Officers elected are W. J. Thackston, president and treasurer; J. R. Vandiver, vice-president; T. F. Hill, secretary, and E. A. Smith, chairman of the executive committee. The capital stock was fixed at $600,000.

ESSEX, CONN.—The new road which the Shore Line Electric Railway Company is building between Essex and Stony Creek, and which is the most ambitious trolley project now under construction in Connecticut, will be completed this spring. Practically all of the roadway, for a distance of nearly forty miles, has been finished, except a stretch in the town of Guilford. Work remains to be done on several small bridges owing to the delayed arrival of materials. The poles have been set and the wires strung for long distances. The big power house on the shores of the Connecticut River at Saybrook has been completed. The route runs through a series of populous communities that are now isolated from trolley facilities. Shore Line cars will be run from Stony Creek into New Haven over the tracks of the Connecticut company.

TOLEDO, O.—The street car situation in this city is attracting more than ordinary attention at this time. Many of the franchises on principal streets will expire within the next few months and the difference of opinion between the city officials and the present holder of the franchises, the Toledo Railways and Light Company seems to present a hopeless situation. The present city administration was elected to office upon a flat-footed three-cent fare platform. On the other hand the officials of the street car company announce that three-cent fares are an impossibility. Councilman Batch recently introduced a resolution directing the city solicitor to prepare a franchise ordinance in conformity with the notions of the council. It was then referred to a council committee. W. W. Miller, attorney for the street railway bondholders, communicated with Mayor Brand Whitlock asking for suggestions as to what was desired. The mayor in a curt reply stated that the statutes indicate the steps to be taken by cities when franchises expire and that if the Toledo Railways and Light Company, or any one officially representing it has any proposition to make it should be presented to the council, where it will receive such consideration as it may merit. Just what the outcome will be is being awaited with much interest. The present bondholders' committee includes J. R. Nutt, Norman B. Ream, Myron T. Herrick, C. Ledyard Blair, John Sherwin, H. P. McIntosh, W. B. Hale and W. L. McKennie. H.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

SAVO, S. D.—Emil Lamatti will construct a telephone line to Ellendale, N. D. C.

PLUMMER, MINN.—The Clearwater Telephone Company will install a new switchboard. C.

RANCHER, MONT.—A telephone company has been organized with Jas. B. Grierson as secretary. C.

MELSTONE, MONT.—It is expected to extend the telephone line to connect with Forsyth the coming summer. C.

BRULE, WIS.—The Brule Telephone Company has been organized by T. W. Jay, J. Webster and Henry Denney. C.

FERGUS FALLS, MINN.—The Otter Tail County Telephone Company, a co-operative company, is being organized. C.

JAMESTOWN, N. D.—The Northwestern Telephone Exchange Company expects to add more cables and increase its facilities this spring. C.

CHISHOLM, MINN.—The Mesaba Telephone Company is arranging for the construction of new lines, addition of new cables and other improvements.

MOTLEY, MINN.—The Motley Telephone Company, capital $10,000, has been incorporated. V. Lockwood is president, and S. W. Jacobs, secretary and treasurer. C.

FARGO, N. D.—The Collins Northwestern Wireless Telephone and Telegraph Company has a consignment of long distance equipments coming from Newark, N. J. C.

YAMHILL, ORE.—The Yamhill Mutual Telephone Company, with a capital stock of $2,500 has been incorporated by W. G. Moore, E. B. Flett and A. C. Goodrich.

CENTERVILLE, WASH.—The Centerville Telephone Company with a capital stock of $5,000, has been incorporated by Henry Garner, Theodore Jackel and Henry Jackel.

FAIRMONT, MINN.—The Fairmont Telephone Company voted to order material for the rebuilding of all of the north portion of the local exchange. The cost will be about $2,000. C.

ADDISON, N. Y.—The Addison Home Telephone Company has been incorporated with a capital of $10,000. The promoters are: A. Manley, G. B. Stephens, E. C. Smith, all of Addison.

MADISON, WIS.—The Cook County Line Telephone Company, Tisch Mills, with a capital stock of $5,000, has filed articles of incorporation. Arthur V. de Never is the principal stockholder. M.

LEBANON, N. J.—The Lebanon Telephone Company has organized with the following officers: President, S. J. Shurts; vice-president, George Clark; secretary, O. A. Farley; treasurer, S. J. Shurtz; manager, Erastus W. Sutton.

MADISON, WIS.—The Interurban Telephone Company elected the following officers at its annual meeting here last week: President, Conrad Engsberg, Lake Mills; George Maloney, vice-president, and A. C. Hoppman, secretary and treasurer. M.

GREELEY, COL.—At a cost of $5,000 per mile a new cable for telephone wires will be laid from Greeley to Lucerne, a distance of four miles. Sixteen carloads of conduit have arrived for placing more than two miles of wire underground. The company is now erecting a new building at a cost of $20,000. The equipment will cost the company $25,000. The underground wiring and the aerial plant will cost $90,000, making a total of $135,000 spent in Weld County on new equipment this year.

NEW RICHMOND, WIS.—An independent telephone company has been incorporated under the name, St. Croix Valley Telephone Company, and capitalized at $25,000, more than the necessary amount of stock having been subscribed. The plan is to make this new company, in view of its central location and advantageous position, the clearing house for all the independent telephone companies up and down the St. Croix Valley. It is expected the new exchange will be in operation within sixty or ninety days. The new company will be allied with the Tri-State and Twin City independent companies.

CHARLOTTE, N. C.—The Newell Telephone Company, recently organized as a rural telephone system with about fifty subscribers, has completed a contract with the Southern Bell Telephone Company for connection by trunk line with Charlotte, and the general long-distance service of the Bell Company. This rural system is one of many that are being organized following a vigorous campaign by the Southern Bell Company throughout the county and rural districts to interest farmers in the telephone, and the results to date have been exceedingly gratifying to those promoting the new movement. L.

RALEIGH, N. C.—The annual gathering of the stockholders of the Capital City Telephone Company was held in Raleigh a week ago and directors were elected as follows: W. D. Gentry, of Atlanta, Ga.; W. W. Shaw and George W. Watts, of Durham, N. C.; A. B. Andrews, Jr., and Wm. Boylan, of Raleigh, and J. M. B. Hoxsey and Addison Maupin, of Atlanta, Ga. The directors elected officers as follows: W. D. Gentry, president; J. M. B. Hoxsey, vice-president, and Addison Maupin, secretary and treasurer, with Wm. Boylan local manager of the exchange in Raleigh.

TRENTON, N. J.—Papers have been filed with the Secretary of State merging some of the subsidiary concerns of the Bell Telephone system. The Delaware & Atlantic Telephone and Telegraph Company, of New York, and the Delaware & Atlantic Telephone and Telegraph Company of New Jersey were merged into one company, to be known as the Delaware & Atlantic Telephone and Telegraph Company. The Northeastern Telegraph and Telephone Company, the Hudson River Company and the Seashore Telephone Company were merged into the New York Telephone and Telegraph Company. The purpose of the mergers is to reduce the number of separate concerns operating under the Bell system.

ELECTRICAL SECURITIES.

Contrary to the expectations of many the stock markets of last week in New York lapsed into a state of inactivity equal to the dull periods of midsummer and February of last year. The movement of prices, at the same time, became sluggish and irregular. This condition coming after the rebound from the severe depression, demonstrated the completion of a larger movement of liquidation, its accompanying over extension of a short interest and the subsequent correction of that excess. A waiting period for new factors to develop, during which dealings are small and price fluctuations narrow, is a usual sequence to such markets. The passing of the effect of factors lately influential was indicated by the indifference shown to the public address of the attorney general reiterating the policies of legal restraints on corporations. Labor disputes to be adjusted are kept in mind by the Philadelphia riots and by demands upon various railroads to which answer must be made. Authorities in the iron and steel trade express hopeful views of the demand for financial products.

The gross earnings of the Butte Electric and Power Company for the year 1909 amounted to $1,656,269, and net earnings to $997,575.

President Riley, of the Chicago Title and Trust Company, succeeds President Mitten on the executive committee of the Chicago City Railway Company.

The stockholders of the Detroit Edison Company have outhorized the proposed issue of $3,000,000 six per cent convertible debenture bonds, and have increased the capital stock from $6,000,000 to $9,000,000. The new bonds will be offered to stockholders for subschiption pro rata.

The directors of the Chicago Pneumatic Tool Company have passed a resolution calling for the declaration of a quarterly dividend of one per cent on March 22, payable April 25 to stockholders of record April 15. Dividends which had been paid ot the rate of four per cent annually were discontinued in 1907.

The directors of the Otis Elevator Company have decided to recommend an issue of $3,500,000 five per cent convertible bonds, and a special stockholders' meeting has been called for March 21 to authorize the bond issue, and to provide for an increase in the capital stock for $6,500,000 to $10,000,000 to take care of the conversion of the new bonds. The new bonds are convertible into the common stock after April 1, 1913, at par.

At the annual meeting of the Massachusetts Lighting Company, held in Boston, the trustees were authorized to issue 3,600 additional shares of stock. The new stock is to be offered to stockholders of record February 23 at $110 per share in the ratio of one share for each twenty shares now held. This will increase the outstanding stock of the Massachusetts Lighting Companies to $5,030,300. The proceeds of the new stock issue will be used for payment for the capital stock of the North Traction Gas Light Company, recently purchased by the company.

DIVIDENDS.

Butte Electric and Power Company; quarterly dividend of one and one-half per cent on common, payable April 1.

Galveston-Houston Electric Company; semiannual dividend of $3 per share on the preferred capital stock, and a dividend of $1.50 per share on the common capital stock, payable March 15, to stockholders of record at the close of business March 4.

Mackay Companies; one and one-quarter per cent on common and one per cent on preferred, both quarterly, payable April 1.

New England Telephone and Telegraph Company; quarterly dividend of $1.50, payable March 31.

NEW YORK.

	Feb. 28	Feb. 21
Allis-Chalmers common	11⅞	12⅜
Allis-Chalmers preferred	41	42½
Amalgamated Copper	76	76⅜
American Tel. & Cable	*80	*80
American Tel. & Tel.	140⅜	137⅜
Brooklyn Rapid Transit	74⅝	73⅝
General Electric	153	155½
Interborough-Metropolitan common	21	22⅛
Interborough-Metropolitan preferred	55	55⅜
Kings County Electric	130	129
Mackay Companies (Postal Telegraph and Cables) common	89	89
Mackay Companies (Postal Telegraph and Cables) preferred	76	76
Manhattan Elevated	135	135
Metroplitan Street Railway	16	16
New York & New Jersey Telephone	123½	123
U. S. Steel common	80⅝	80½
U. S. Steel preferred	119¾	120
Western Union	74½	72½
Westinghouse common	70½	69
Westinghouse prreferred	130	125

BOSTON.

	Feb. 28	Feb. 21
American Tel. & Tel.	140⅜	137⅜
Edison Elec. Illuminating	248	248
General Electric	153	155½
Massachusetts Electric common	17½	17¾
Massachusetts Electric preferred	83	83
New England Telephone	135½	136
Western Tel. & Tel. common	14	14
Western Tel & Tel. preferred	89½	88½

PHILADELPHIA.

	Feb. 28	Feb. 21
American Railways	46½	46½
Electric Company of America	11⅞	11⅞
Electric Storage Battery common	60	59
Electric Storage Battery preferred	60	59
Philadelphia Electric	15⅜	15¼
Philadelphia Rapid Transit	24½	25⅞
Philadelphia Traction	88¼	89
Union Traction	50½	51

CHICAGO.

	Feb. 28	Feb. 21
Chicago Railways, Series 1	106	105
Chicago Railways, Series 2	33	30
Chicago Subway	3½	3½
Chicago Telephone	128½	128½
Commonwealth Edison	115½	115
Metropolitan Elevated common	16	16
Metropolitan Elevated preferred	51	51
National Carbon common	106	106
National Carbon preferred	118	118

PERSONAL MENTION.

A. H. Ford, of Birmingham, Ala., was elected president of the Birmingham Light, Heat and Power Company at a recent meeting of the board of directors.

WM. E. PIERCE, of Toledo, O., has been appointed Superintendent of the Toledo and Western Railroad and the Adrian, Mich., street railway, with headquarters at Sylvania, O.

A. M. MORSE, for several years district sales manager of the Harrisburg Foundry and Machine Works, has recently resigned his position with that company. Mr. Morse will, however, retain his offices in the Marquette Building at 204 Dearborn Street, Chicago.

H. A. ALLEN, senior member of the engineering firm of H. A. Allen & Company, has been appointed consulting engineer for the department of public works, Chicago. Mr. Allen is a graduate of the United States Naval Academy and was for several years connected with the firm of E. P. Allis & Company of Milwaukee.

ELWIN C. FOSTER, who has for some time been president of the New Orleans Railway and Light Company, is now connected with Sanderson & Porter, 52 William Street, New York city. Mr. Foster was at one time vice-president and general manager of the subsidiary companies of the Massachusetts Electric Companies.

W. A. TEN WINKEL, for over five years manager of publicity of the Electric Controller and Manufacturing Company, Cleveland, Ohio, has resigned to become affiliated with the Penton Publishing Company, of Cleveland. Mr. TenWinkel has been very successful as a publicity manager. He is an expert in the art of photography, has a remarkable faculty for laying out and providing fine effects in printed matter, and is exceptionally capable as an estimator and copy writer. His wide experience in the advertising field and his acquaintance among important steel mill and foundry men will make him a strong factor in the organization at which he now goes.

PROPOSALS.

POST OFFICE, PERU, IND.—The office of the supervising architect will receive sealed proposals until March 30 for the construction, complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the United States post office at Peru, Ind., in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Peru, Ind., or at the supervising architect's office.

POST OFFICE, CONNERSVILLE, IND.—The office of the supervising architect, Washington, D. C., will receive bids until March 23 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the United States post office at Connersville, Ind., in accordance with drawings and specification, copies of which may be obtained from the custodian at Connersville, Ind., or at the supervising architect's office.

POST OFFICE, INDEPENDENCE, MO.—The office of the supervising architect, Washington, D. C., will receive bids until April 5 for the construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the United States post office at Independence, Mo., in accordance with drawings and specification, copies of which may be obtained from the custodian of site at Independence, Mo., or at the supervising architect's office.

LIGHTING FOR BARNESVILLE, O.—Sealed bids will be received until March 17, 1910, at the clerk's office of the village of

Barnesville, State of Ohio, for lighting with electric lights the streets and avenues, alleys, public grounds, public places and municipal buildings of that village for a term of ten years in accordance with the specifications adopted by the Council of the village. Copies of said specifications will be furnished by the clerk on request. Each bid must contain the full name of every person or company interested in the same and be accompanied by a certified check on some solvent bank in the sum of $150 as a guaranty that if the bid is accepted a contract will be entered into and its performance properly secured.

NEW INCORPORATIONS.

PLAINVILLE, CONN.—The Empire Electric and Manufacturing Company has been incorporated to manufacture electric fittings. The capital is $50,000 and the incorporators are Benjamin Lumb, of Plainville, and W. H. Johnston, of New York.

NEW YORK, N. Y.—The Electric Conversion Company has been incorporated with a capital of $2,000, to do general contracting and electrical work of all kinds. The incorporators are: Oris S. Knepper, Floyd W. Parsons and Joseph T. Shaw, all of 42 Broadway, New York.

NEW YORK, N. Y.—The Litharge Battery and Supply Company has been incorporated with a capital of $5,025, for the purpose of manufacturing electric batteries and electrical supplies. The incorporators are: Frank J. Schalow, Baltrus S. Yankaus and John W. Sankaltes.

WAYCROSS, GA.—The Southern Electric Supply Company has been formed at this city and is already getting a good share of the business electric, selling motors, generators and all other electric supplies. The company not only deals in all sorts of electrical supplies but also does electrical construction in Waycross and the surrounding towns. B.

SCHENECTADY, N. Y.—The Kendrick Railway Switch Company has been incorporated with a capital of $50,000 for the purpose of manufacturing and dealing in railway switches and electrical and mechanical devices for the operation of switches. The incorporators are: Aaron Levi, James E. Inglis and Benjamin Terk, all of Schenectady, N. Y.

BIRMINGHAM, ALA.—The Watson Contracting Company has been incorporated in Birmingham, with a capital stock of $5,000. The company will do a general contracting business, including electrical work. The officers are: W. L. Woodruff, president and treasurer; W. L. Watson, vice-president and general-manager, and C. W. Woodruff, secretary. B.

BIRMINGHAM, ALA.—The Hodges-Downey Construction Company, with an authorized capital stock of $100,000, has filed papers of incorporation in the Probate Court. The company will start business with the full amount of the capital stock paid in. The offices will be in Birmingham. A general construction business for the building of railways, highroads and canals, together with general building, will be carried on. The officers of the company are: James Downey, president and general manager; H. C. Hodges, vice-president; J. C. Hodges, secretary and treasurer, and Daniel Downey.

NEW PUBLICATIONS.

RESULTS OF MAGNETIC OBSERVATIONS.—The Department of Commerce and Labor has incorporated the results of the magnetic observations made by the coast and geodetic survey between July 1, 1908, and June 30, 1909, into a booklet. This publication contains observations made at the five magnetic observatories situated in various States and Territories. The methods of taking observations are included and some remarks as to the probable accuracy of the results. Another pamphlet includes the distribution of the magnetic declination in Alaska and adjacent regions for 1910.

CONVENTION REPORT OF THE INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.—The International Association of Municipal Electricians has issued the report of the fourteenth annual convention at Atlantic City, N. J. This volume contains a complete stenographic report of the meeting, the reports of various committees and portraits of the officers. Among the papers read before the convention was an exceedingly interesting one on "The Construction of Underground Conduits," which was read by W. S. Devlin. This was followed by a very complete discussion which brings out many vital points of conduit construction. The secretary of the association is Frank P. Foster, Corning, N. Y.

ARMOUR ENGINEER.—The student body of Armour Institute of Technology has published the January issue of the Armour Engineer. The current number of this semi-annual publication contains a number of very interesting papers written by students and by former students who have had much valuable experience since graduation. A report of the Evanston track elevation of the Chicago, Milwaukee and St. Paul Railway by E. O. Greifenhagen, gives an excellent account of the work done by that road and contains a great deal of valuable material on bridge designs. The question of valuation of electric railway property was quite fully treated by H. Ralph Badger. E. A. Mac Ewing, of the class of 1910, contributed a very complete account of the Gary works of the Indiana Steel Company. The magazine as a whole contains much of interest and is quite fully illustrated with engravings and diagrams.

INDUSTRIAL ITEMS.

THE AMERICAN HOIST & DERRICK COMPANY, of Minneapolis, Minn., is enlarging its power plant by the addition of an Allis-Chalmers 1,000 kilowatt, 440-volt, three-phase turbine-driven unit.

THE ROME WIRE COMPANY, Rome, N. Y., is mailing a very attractive postal card showing a beautiful flower girl and a calendar of the month of March. The reverse side of the card advertises their Romeoid Electrical Wires.

THE ELECTRIC CONTROLLER AND MANUFACTURING COMPANY, Cleveland, Ohio, in the February issue of *Common Sense*, presents the second installment of an interesting article on dynamic braking. In addition the usual amount of interesting, instructive and amusing reading matter is contained in this number.

THE H. T. PAISTE COMPANY, Philadelphia, Pa., has recently sent out the February issue of *Paistery*, a monthly bulletin devoted to improved and approved electrical wiring supplies. In this issue molding taplets, cross-overs for molding wiring, steel surface boxes, pipe taplet elbows and pipe taplet outlet hoods are illustrated and described.

THE WESTERN ELECTRIC COMPANY has recently received from the press its 1910 fan motor bulletin. This bulletin takes up in considerable detail the different types of fan motors which the Western Electric Company is offering for the season of 1910. The bulletin is well illustrated and contains valuable data and other information, aside from a complete description of each of the fan motors which are shown.

THE DELTA-STAR ELECTRIC COMPANY, Chicago, Ill., is distributing pages 3 and 4 of its new loose-leaf price list. Complete information is given on a line of new high-tension entrance tubes, potheads and insulating compound. The technical section of the price list is of exceptional interest in that it gives data on high-tension lines, sparking distance and the critical voltages at which corona effects occur.

THE CUTLER-HAMMER CLUTCH COMPANY, Milwaukee, Wis., is distributing a folder devoted to the Cutler-Hammer lifting magnet. An interesting feature in this publication is a large cross section drawing of the magnet which shows in detail the design of each part and the method of assembling. There are also a number of photographs reproduced which show the various applications of these magnets and others which show the ease with which they are inspected.

THE WESTERN ELECTRIC COMPANY has just received from the press bulletin No. 5230, which describes in detail their Hawthorn-type "SL" induction motor. The bulletin is well illustrated and includes a description of all the essential parts of the motor. The company also announces that the telephones formerly known as "Intercommunicating" or "Private Line Telephones" will be called "Western Electric Inter-phones." The word "Inter-phone" is to be used to the exclusion of the old designations.

THE NATIONAL BRAKE AND ELECTRIC COMPANY, Milwaukee, Wis., in a recently issued, attractive publication, known as No. 387, describes in detail its National 3VS type, electrically-driven air compressors. These compressors are motor-driven, power being transmitted from the motors to the compressors by means of a herring-bone pinion and gear. The National compressors are designed for continuous service against a load of from sixty pounds to 100 pounds per square inch, but can be furnished for pressures up to 150 pounds per square inch.

THE UNITED STATES LIGHT AND HEATING COMPANY, New York, N. Y., is distributing a book of instructions, for the care and operation of National storage batteries for pleasure and commercial vehicle service. This publication, which is known as Bulletin No. 107, covers every phase of storage battery work and should prove valuable to vehicle owners, operators, and garage attendants alike. Among the important points covered are: Directions for charging, methods of connecting and disconnecting cells, assembling and putting into commission old and new batteries and a number of tables and formulae.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., has received an order from the New River and Pocahontas Consolidated Coal Company for equipment to be used in the developments at Berwind, W. Va. The generating set ordered is a 1,000-kilowatt, 6,600-volt, three-phase steam turbine-driven unit. The Glenlyon Dye Works, of Philipsdale, R. I., has found that its Allis-Chalmers 500-kilowatt generator installed a year ago is not large enough to meet their increased power demands and has ordered a second turbine set of the same make. The new generating set is to have a capacity of 750 kilowatts.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has recently issued Bulletin No. 4714, describing railway signal volt-ammeters. The bulletin contains several illustrations of this instrument, which is arranged for four capacities or combinations, so that two voltage ranges and two current ranges, or three current ranges or one voltage range can be obtained. Several reproductions of the meter scales in actual size are also shown. Bulletin 4715, issued by the same company, gives a very interesting description of type G. E., 210 railway motors. Several illustrations are incorporated in the detailed description of this motor. The bulletin contains a speed table, characteristic curves and dimension diagrams.

THE KELLOGG SWITCHBOARD AND SUPPLY COMPANY has issued an ingeniously prepared booklet describing and illustrating the telephone transmitter. The booklet is made up in the exact size and shape of this transmitter and contains a full description of the instrument. "Kellogg Mine Telephones," which is the subject of another booklet, treats of the telephones such as are used in mines, lumber camps and on railroads. These telephones are especially recommended for reliability and accessibility. A small pamphlet which deals with the care of gravity batteries has also been sent out, and will undoubtedly be of interest to all using such batteries

THE ILLINOIS APPLIANCE COMPANY, Chicago, Ill., manufacturer of the well-known adaptable lamp changer, announces that owing to the increasing demand for these changers it was found necessary to move to more commodious quarters at 613 Crilly Building, Chicago, where with increased facilities prompt attention can be given all orders. H. H. Woods has accepted the position of sales manager of the company and will look after that end of the business. A change has been made in the adaptable lamp changer which greatly improves it and improves its construction generally. The eight prongs are now set in the head tube and baked over a grove in the same, they are then plugged in with a milled piece which is pinned in with a German silver pin. The whole is then nickel plated.

THE H. W. JOHNS-MANVILLE COMPANY, New York, N. Y., has found it necessary, due to fast increasing business, to move both the Chicago and Baltimore branches into new and larger quarters. The Chicago branch, now on Randolph Street, will move to the four-story building at Nos. 27-29 Michigan Avenue, located in the block between South Water and River Streets. With 32,500 square feet of floor space, offices, store and stock room will all be under one roof, with ample room for all. A full stock of J-M products will be carried, thus assuring prompt shipments. The Baltimore office, store and warehouse will be located at No. 30 Light Street, where the company will have considerably more room than before.

DATES AHEAD.

Minnesota Electrical Association. Annual convention, Minneapolis, Minn., March 29, 30 and 31.

Missouri Electric, Gas, Steel Railway and Water Works Association. Next convention, Jefferson City, Mo., April 14, 15 and 16.

Florida Electric Light and Power Association. Next meeting, Tampa, Fla., April 21.

Iowa Electrical Association and Iowa Street and Interurban Railway Association. Annual conventions, Sioux City, Ia., April 20 and 21.

National Electric Light Association. Annual convention, St. Louis, Mo., May 23-28.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) February 22, 1910.

949,784. ARMATURE FOR ELECTRIC GENERATORS. Henry Tideman, Menominee, Mich. Filed November 23, 1905. The armature has a body formed of perforated laminas bound together by a longitudinal rivet passing centrally through them, and extensions for the core are composed each of smaller laminas.

949,797. DIAL FOR SELECTIVE SIGNALING APPARATUS. Daniel W. Knisely, Dayton, O., assignor to the Dayton Telephone Lockout Manufacturing Company, Dayton, O. Filed May 3, 1909. A series of finger holes are provided in a revoluble dial plate having spring fingers extending across the finger openings. Pressure of the fingers cause a stop member to be engaged, thereby limiting the revoluble movement of the dial.

949,799. ELECTRIC SWITCH. Delma E. Lee, Pontiac, Wash. Filed October 6, 1908. A form of push-button switch is provided with an arc extinguisher.

949,814. SUPPORT FOR TELEPHONE-RECEIVERS. Robert Zinsmayer, Sandusky, O., assignor of three-tenths to Albert Krapp and three-tenths to Charles L. Blatz, Sandusky, O. Filed May 7, 1909. Describes an adjustable support for the receiver of a desk telephone set.

949,821. TELEPHONE-RECEIVER. Claude D. Enochs, La Crosse, Wis. Filed January 13, 1908. Auxiliary magnet coils are provided with means to reduce their impedance.

949,836. SELECTOR. James L. McQuarrie and Edward B. Craft, New York, N. Y., assignors to Western Electric Company, Chicago, Ill. Filed January 18, 1908. Describes a selector switch and controller mechanism.

949,844. CIRCUIT-CONTROLLED SWITCH. Walter Richmond, Memphis, Tenn. Filed February 18, 1909. A two-point switch is actuated by a pair of axially alined solenoids.

949,867. ILLUSION-SIGN. Leonard A. Watkins, Chicago, Ill. Filed April 8, 1909. A transparency back of a sign-plate is illuminated from behind by an electric light and is caused to revolve by means of a motor.

949,874. OVERLOAD REVERSING SWITCH. Thomas E. Barnum, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Filed July 25, 1906. The switch has cylindrically arranged contacts, a latch adapted to catch the switch and hold it in a predetermined position, an overload magnet adapted to trip the latch, and means for retracting the switch when the latch is tripped.

949,881. ALARM AND CURRENT-SAVING APPARATUS FOR AUTOMATIC EXCHANGES. Albert M. Bullard, New York, N. Y., assignor to Western Electric Company, Chicago, Ill. Filed February 6, 1908. The switching mechanism in a telephone exchange is responsive to current in the line circuit and is adapted for rapid intermittent operation; a device responsive to a continued flow of current in the line circuit, but not responsive to rapidly-changing current, and means controlled by the responsive device for cutting off the supply of current are also provided.

949,895. ELECTRIC FURNACE. Alois Helfenstein, Vienna, Austria-Hungary. Filed December 11, 1908. Comprises a dome mounted over the furnace chamber, an electrode suspended into the furnace chamber, means to prevent the escape of gases from the furnace, a cone at the lower end of the dome and a water-cooling jacket for the cone.

949,921. CABLE CONNECTION. Olof Tangring, Worcester, Mass., assignor to American Steel and Wire Company, Worcester, Mass. Filed June 13, 1906. Describes a connector for multiple-strand electric cables.

949,923. RHEOSTAT. Henry J. Wiegand, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Filed March 29, 1909. Elongated resistance plates are divided into groups obliquely in opposite directions.

949,934. GENERATOR SUSPENSION FOR TRAIN-LIGHTING SYSTEMS. Patrick Kennedy, New York, N. Y. Filed September 29, 1909. A dynamo is contained within a cradle located between a bracket and an end sill of the car-truck, the bracket extending outside of the sill.

949,946. ELECTROLIER. Bernard A. Stowe, Cleveland, O., assignor to the Jandus Electric Company, Cleveland, O. Filed August 15, 1908. The two separable casings of a hollow casing are attached one to a support and the other to a translating device.

949,952. RELAY. George F. Atwood, New York, N. Y., assignor to Western Electric Company, Chicago, Ill. Filed July 13, 1907. Describes a polarized relay.

949,970. ELECTRICALLY-OPERATED NON-INTERFERING ALARM CALL-BOX. Peabody A. Brown, Denver, Col. Filed February 1, 1909. The box is provided with a latching door spring controlled to fly open when unlatched, the latch being protected by a breakable seal.

949,985. ELECTRIC-LAMP SOCKET. Frederick A. Lavercombe, Newport, Ky. Filed November 21, 1908. The socket is held against rotation when a clamping nut is tightened.

949,988. TREATED CARBON AND THE METHOD OF PRODUCING IT. Peter J. Mulvey, Schenectady, N. Y., assignor to General Electric Company. Filed December 2, 1904. The method consists in filling the pores of a carbon brush with a lubricating material and then expelling from the brush a portion of the lubricating material leaving only an amount which will not be expelled from the brush at temperatures at which it is operated.

949,992. COMMUTATOR-MOTOR. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to General Electric Company. Filed June 1, 1908. Describes a form of commutor motor adapted for operation on both direct and alternating current.

949,995. MOTOR-CONTROL SYSTEM. Eugene R. Carichoff, East Orange, N. J., assignor to General Electric Company. Filed January 28, 1905; renewed February 23, 1906. Describes a system of train control.

949,997. CURRENT-RELAY. Archibald S. Cubitt, Schenectady, N. Y., assignor to General Electric Company. Filed April 17, 1906. A plunger is caused to move into one of two coils by the energization of the relay.

949,998. CONTROLLER-REGULATOR. Archibald S. Cubitt, Pittsfield, Mass., assignor to General Electric Company. Filed October 15, 1909. A disk on a rotatable shaft carries a number of dogs, which ride over a stationary cam and pass normally under a stationary stop, but which are engaged by the latter when the speed is excessive.

950,000. ARC-LAMP. Robert Hewson, Lynn, Mass., assignor to General Electric Company. Filed June 5, 1908. A free weight

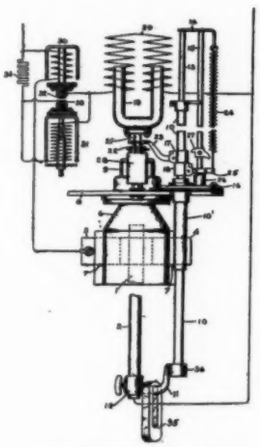
impinging on one of the electrode carriers in the direction of its arc-striking movement is provided as a means for separating wedged or frozen electrodes.

950,001. SPARKING DEVICE FOR INTERNAL-COMBUSTION ENGINES. Louis K. Leahy, Los Angeles, Cal. Filed August 17, 1905. An internal combustion engine is provided with a plurality of igniting means and means to move one of these out of communication with the combustion chamber of the engine and simultaneously to move another into such communication.

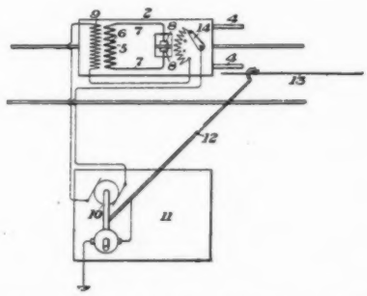
950,004. RAILWAY TELEPHONE SIGNALING APPARATUS. August A. Monson, North St. Paul, Minn., assignor of one-half to Frank W. Moffett, St. Paul, Minn. Filed July 2, 1908. A selector is provided having two relays, one of high impedance and one of low impedance, and connections are made so that the action of a (second) local circuit is not completed until the line relay has permanently closed at the end of an interview.

950,023. APPARATUS FOR HEATING AND SEPARATING METALS. James H. Reid, Newark, N. J. Filed May 5, 1909. The upper portion only of the charge in a vessel is electrically heated during the rotation of the vessel.

950,033. APPARATUS FOR BRAZING OR WELDING RAIL-BONDS. Charles R. Sturdevant, Worcester, Mass., assignor to American Steel and Wire Company, Chicago, Ill. Filed March 31, 1909. Comprises a light vehicle adapted to travel on a single track rail, brazing or welding electrodes carried thereby, a welding transformer mounted thereon, a separate vehicle adapted to travel or to be sent temporarily at one side of the track, apparatus on the vehicle for furnishing the transformer with current, and flexible conductors connecting the apparatus with the transformer.



950,000—ARC LAMP.



950,033—APPARATUS FOR WELDING RAIL-BONDS.

950,037. MUSIC-LEAF TURNER. Alvin E. Babcock, Battle Creek, Mich. Filed January 21, 1909. The device is electromagnetically actuated and electromagnetically released from a locked position.

950,047. REPEATING MECHANISM FOR TELEGRAPH-CIRCUITS. James G. Kerr, London, Ontario, Canada. Filed November 3, 1908. Describes a telegraph sounder and repeater.

950,058. ELECTRIC HEATER. Frank E. Shailor, Detroit, Mich., assignor to General Electric Company. Filed July 12, 1909. High-resistance coils of bare wire are wound on an insulating support, a base holds the same in a vertical position, and a metal cage provided with baskets at the sides incloses the coils.

950,068. ELECTROPLATING-APPARATUS. Nathan S. Emery and Benjamin W. Gilchrist, Woodhaven, N. Y. Filed August 16, 1909. Removable drums are revolved by worm gearing.

950,079. ELECTRIC METER. Gustave A. Scheeffer, Fort Wayne, Ind., assignor to General Electric Company. Continuation of abandoned application filed September 12, 1902. This application filed January 2, 1904. Comprises an armature of conducting material, a series winding, adjacent thereto, and a shunt winding provided with a channel-shaped core of magnetic material having a plurality of sets of inwardly-projecting poles, the magnetic flux of part of the poles acting on the armature.

950,105. VIBRATOR FOR SPARK-COILS. Edward B. Jacobson, Pittsfield, Mass. Filed November 12. 1907. A pivotal mounting for the vibratile element permits lateral movement, and a stop holds the vibratile element in its normal position.

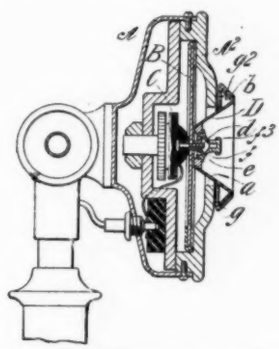
950,107. SWITCHBOARD JACK AND PLUG. Alfred Larsson, Stockholm, Sweden, assignor to L. M. Eriscson Telephone Manufacturing Company, Buffalo, N. Y. Filed April 23, 1909. The jack-springs have contact faces which progressively increase in length toward the front of the jack, and the plug has corresponding contracts which progressively diminish in length toward the front of the plug.

950,124. HIGH-POTENTIAL-ALTERNATING-CURRENT RECTIFIER. Chester H. Thordarson, Chicago. Filed December 7, 1908. Comprises a rotative shaft, a plurality of light, angularly separated arms made of non-conducting material fixed radially to and revolving with the shaft, commutator members carried by the outer ends of the arms and connected with a source supplying alternating current, means for preventing flexure of the arms out of their plane of rotation, and a plurality of collector plates with which the commutator members have wiping contact, consecutive ones of which collect opposite polarities of a unidirectional current from said commutator members.

950,126. GAS-ENGINE IGNITER. Stephen F. Briggs, Milwaukee, Wis., assignor to the firm of Briggs & Stratton, Milwaukee, Wis. Filed February 4, 1909. Comprises an induction coil rotatably mounted in a casing and having driving connection with the engine, a circuit interrupter for the primary circuit of the induction coil actuated by the movements of the coil, cylinder terminals on the casing for connection with the spark plugs of the several cylinders of the engine, and a distributing terminal carried by the induction coil for the secondary circuit thereof adapted to establish connection for the secondary circuit with the successive cylinder terminals on the casing.

950,130. STARTING-SWITCH FOR ELECTRIC MOTORS. Edmund Garside, Darlington, England, assignor to Engineering Instruments, Limited, Darlington, England. Filed September 8, 1909. A spring is stressed by a yoke through a toggle device operated by the switch arm so as to act on a contact device.

950,168. COMBINED JACK AND DROP FOR TELEPHONE-SWITCHBOARDS. Claude D. Enochs, La Crosse, Wis., assignor to the Vote-Berger Company. Filed April 30, 1906. A drop includes a shutter having an inturned tongue; a jack is associated with the drop and is provided with a plug socket; a slide normally closes the socket; and a spring is adapted to close the slide and restore the shutter when the slide is opened.



950,229—TELEPHONE-TRANSMITTER.

950,176. OUTLET-BRACKET FOR ELECTRIC FIXTURES. Newton Hublinger, Akron, O. Filed February 26, 1909. Describes a form of bracket adapted to support in alternation various forms of electrical devices.

950,210. SWITCH-THROWER FOR ELECTRIC RAILWAYS. James A. Posey, Waxahachie, Tex., assignor to John F. Dunaway, Waxahachie, Tex. Filed November 15, 1909. A solenoid is provided for throwing a switch tongue to a branch line, and another solenoid for throwing a switch tongue to the main line.

950,213. DIRECT-CURRENT MOTOR. Alfred L. Sohm, Whittier, Cal., assignor of one-third to Triphon D. Heyl and one-third to Chester L. Adams, Whittier, Cal. Filed September 16, 1908. The armature has a portion of magnetic metal increasing in bulk circumferentially, and disposed in proximity to and under the magnetic influence of a plurality of field magnets, and means are provided to successively de-energize each of the field magnets when the portion of the armature of greatest bulk is opposite thereof.

950,214. SPARK-PRODUCING DEVICE. Fredus A. Thurston, Chicago, Ill. Filed October 17, 1904. Describes a kind of spark plug.

950,220. TELEPHONE PAY-STATION. Francis X. Bee, Philadelphia, Pa. Filed August 19, 1909. Describes the coin chutes and associated mechanism.

950,223. SAFETY RELEASE-MAGNET FOR BRAKE APPARATUS. William N. Dickinson, Jr., New York, N. Y., assignor to Otis Elevator Company, Jersey City, N. J. Filed July 3, 1906. In combination with a motor are a brake therefor, an electro-

responsive device, an armature for the latter, and automatic means dependent on closing a circuit to the motor for moving the electro-responsive device and the armature to effect the release of the brake.

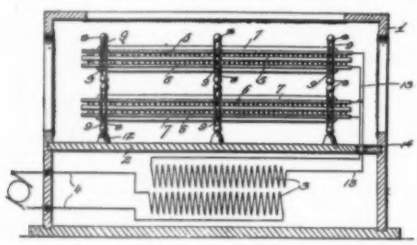
950,224. PROTECTIVE APPARATUS FOR ALTERNATING-CURRENT ELEVATORS. William N. Dickinson, Jr., New York, N. Y., assignor to Otis Elevator Company, Jersey City, N. J. Filed June 9, 1906; renewed June 10, 1909. The brake apparatus is electrically held in released position.

950,228. IGNITING DEVICE FOR INTERNAL-COMBUSTION ENGINES. Robert J. Gibbon, Chicago, Ill., assignor to International Device Company. Filed April 17, 1908. Comprises a plurality of electric igniters, an electric terminal movable successively into engagement with the igniters, and means for moving such terminal step by step.

950,229. TELEPHONE-TRANSMITTER. Felix Gottschalk, New York, N. Y. Filed September 13, 1909. In telephone transmitter comprises a casing having an apertured front wall, the diaphragm in the casing behind such wall, the resistance cup behind the diaphragm having secured thereto a threaded stud which extends forwardly through and beyond the central portion of the diaphragm, a forwardly flaring cup-shaped shell in contact centrally with the diaphragm, and through which the stud forwardly protrudes, a nut screwing on the stud, engaging the shell and clamping it to the diaphragm, and a substantially conical forwardly closed and rearwardly chambered member supported within the cup-shaped shell and inclosing the stud and nut.

950,257. APPARATUS FOR GENERATING UNDAMPED ELECTRIC OSCILLATIONS. Simon Eisenstein, Kiew, Russia. Filed September 5, 1907. Comprises a negative electrode, a plurality of positive electrodes, a condenser connected to each positive electrode, means for establishing oscillations between the condenser and the negative electrode, and means for supplying alternating current separately to the electrodes.

950,258. ELECTRIC CONNECTION FOR MULTIPLE WIRELESS TELEGRAPHY. Simon Eisenstein, Kiew, Russia. Filed November 9, 1907. An aerial conductor is divided into a number of



950,347—OZONE-GENERATOR.

branches each of which is connected with an antenna, each of the branches being connected at certain times to the nodal point of the vibration circuit for the time being.

950,305. ELECTRIC SWITCH. Harry C. Robinson, Coatesville, Pa. Filed April 21, 1909. In combination in a switch of two fixed contacts are: a movable main contact capable of connecting the fixed contacts; an auxiliary contact pivoted on one of the fixed contacts so as to be capable of engaging the other; means for forcibly holding the movable main contact in engagement with the fixed contacts; and means for operatively connecting the auxiliary contact with the holding means for the movable main contact so as to cause said contacts to move in opposite directions under operative conditions.

950,316. ELECTRIC-METER-SERVICE PROTECTIVE APPARATUS. Robert C. Cole, West Hartford, Conn., assignor to the Johns-Pratt Company, Hartford, Conn. Filed June 1, 1909. In combination in a meter service protective apparatus are a service block adapted to receive fusible conductors; a cover adapted to be sealed upon the service block; and a junction box composed of members which are joined together at their lower edges and have their upper edges detachably engaged with the service block.

950,319. SPACER AND INSULATOR FOR STORAGE-BATTERY ELECTRODES. Louis H. Flanders, Edgewood Park, Pa., assignor to Westinghouse Storage Battery Company. Filed August 20, 1907. Grooved plates formed of insulating material space and insulate the edges of the electrodes, and wood sheet separators between the electrodes extend into the same grooves as the electrodes.

950,336. CAR-BRAKE. William C. Marsh, Dunkirk, N. Y. Filed October 14, 1908. Means for frictionally applying the brakes are applied by a solenoid, the movement of the core of which is controlled by a separate electric means.

950,339. SPARKING DEVICE. Thomas H. McQuown, Cambridge, Mass., assignor to Arthur Atwater Kent, Philadelphia Filed July 28, 1905. Comprises a stationary contact, a member carrying a movable contact, a pinion for continuously rotatating the member, a spring connection between the pinion and the member, and means to retard the movement of the member until the movable contact is about to engage the fixed contact and to then release the member to cause the contacts to momentarily engage.

950,347. OZONE GENERATOR. Robert W. Rice, Cleveland, O. Filed October 25, 1909. Perforated platinum plates are arranged on opposite sides of plates of dielectric material. The current is stepped up by means of a transformer.

950,376. AUTOMATIC BLOCK-SIGNAL SYSTEM FOR RAILROADS. Lester O. Dickey, Omaha, Neb., assignor to the Stotts Signal Company, Marion, Iowa. Filed September 20, 1906. A block signaling system comprises a danger and a caution signal at each end of the block, a plurality of caution signals positioned within the block at predetermined distances, means for operating the danger signal at one end and the caution signal at the other as the train enters the block, and means for successively throwing to danger and to safety the various caution signals within the block as the train passes therethrough.

950,389. FUSE-REPLACING DEVICE. Walter L. Green, Denver, Col. Filed December 10, 1908. As a lever is shifted, a slidable fuse-carrying member displaces one set of fuses and substitutes therefor another set in the electric circuit.

950,454. LIGHTNING-ROD. George J. Moore, Maryville, Mo., assignor to Moore Brothers Lightning Rod Company, Maryville, Mo. Filed July 16, 1909. The rod is composed of straight and wrapped small cables entwined together in groups.

950,467. MEANS FOR EFFECTING THE CONTROL OF AN ALTERNATING-CURRENT ELECTRIC MOTOR. August Sundh, Yonkers, N. Y., assignor to Otis Elevator Company, Jersey City, N. J. Filed June 27, 1907. A motor-control system comprises a controlling circuit, a normally open switch in the circuit, an impedance coil in the circuit, means associated with the movable member of the switch for varying the impedance of the coil, and means responsive to such variations for controling the speed of the motor.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired January 17, 1910:

492,402. ELECTRIC TRAIN CONTROLLING APPARATUS. Frank E. Kinsman, Plainfield, N. J.

492,456. SWITCH FOR OPERATING SHUNT-WOUND ELECTRIC MOTORS. Frederick H. Berry, Milwaukee, Wis.

492,467. LONG-DISTANCE ELECTRIC TELEPHONY. Chas. M. Haynes, Omaha, Neb.

492,471. SYSTEM OF COMBINED TELEPHONY AND TELEGRAPHY. Frank A. Pickernell, Newark, N. J.

492,478. ELECTRIC BURGLAR ALARM. Chas. F. A. Sturts, San Francisco, Calif.

492,482. SIGNALING APPARATUS AND CIRCUIT. Edward J. Hall, Morris and Frank A. Pickernell, Newark, N. J.

492,483. BUSY SIGNAL FOR TELEPHONE CIRCUITS. Edward J. Hall, Morris and Frank A. Pickernell, Newark, N. J.

492,484. TELEPHONE CENTRAL STATION CIRCUIT. Jas. J. McQuarrie, Boston, Mass.

492,486. COIN-CONTROLLED MACHINE FOR ADMINISTERING ELECTRICITY. Wm. R. Pope, New York city.

492,492. ELECTRIC CAR BRAKE. Wendell C. Fletcher, St. Louis, Mo.

492,497. ELECTRIC SIGNALING APPARATUS. Wm. H. Kenyon, New York city.

492,519. ELECTRICAL ANNUNCIATOR. John R. Hard, New York city.

492,524. ELECTRIC MOTOR. Franklin H. Beers, Newark, N. J.

492,544. LIGHTNING ARRESTER. Chas. F. Scott, Pittsburg, Pa.

492,545. ELECTRIC SIGNALING APPARATUS. Wesley Trafford, New York city.

492,548 and 492,549. LIGHTNING ARRESTER. Alexander Wurts, Pittsburg, Pa.

492,563. KEYED MUSICAL INSTRUMENT ACTUATED BY ELECTRICITY. Paris E. Singer, London, England.

492,627. APPARATUS FOR ELECTRICALLY-PROPELLED CARS. Chas. J. Kintner, New York city.

492,633. ELECTRIC LIGHTING SYSTEM. Robert W. Rollins, Hartford, Conn.

492,645. ELECTRIC RAILWAY SIGNAL. Howard St. C. Wait, New York city.

492,646. ELECTRIC ALARM MONEY DRAWER. Wm. J. Walker, St. Louis, Mo.

492,650. ELECTRIC ARC LAMP. Wm. P. Wiemann, Allegheny, Pa.

492,659. ELECTRIC RAILWAY. Michelangelo Cattori, Rome, Italy.

492,681. ARMATURE FOR DYNAMO ELECTRIC MACHINES. George Hoare, Newark, N. J.

492,694. ELECTRIC ALARM FOR HOTELS. John McMurrow, Jr., Philadelphia, Pa.

492,713. WELDING METALS ELECTRICALLY. Chas. L. Coffin, Detroit, Mich.

492,737. CONDUIT ELECTRIC RAILWAY. Jas. H. Bates, Hoboken, N. J.